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TAXONOMY OF *ISOCOMA* (COMPOSITAE: ASTEREAE)

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ABSTRACT

The genus *Isocoma* comprises sixteen species, three of which include varietal taxa. Five previously undescribed species are recognized: **I. azteca** *sp. nov.*, **I. felgeri** *sp. nov.*, **I. humilis** *sp. nov.*, **I. tehuacana** *sp. nov.*, and **I. tomentosa** *sp. nov.*. The plants of the Pacific coast previously identified as *I. veneta* (Kunth) E. Greene are recognized as **I. menziesii** *comb. nov.*, including one previously undescribed infraspecific taxon, var. **diabolica** *var. nov.*, and others requiring new varietal combinations: var. **decumbens**, var. **sedoides**, var. **tridentata**, and var. **vernonioides**. Two new combinations are proposed within *I. acradenia* (E. Greene) E. Greene, var. **bracteosa** and var. **eremophila**, and one within *I. coronopifolia* (A. Gray) E. Greene, var. **pedicellata**. Lectotypes are designated for some of the taxa, and distribution maps and keys are provided for all of the currently recognized ones.

KEY WORDS: *Isocoma*, *Haplopappus*, Asteraceae, Astereae, México

Isocoma is a genus of sixteen species primarily endemic to northern México and the southwestern United States. The plants are small, usually glutinous shrubs with discoid heads usually in compact corymbs, goblet shaped corollas, achenes with a pappus of bristles, and a base chromosome number of $x = 6$. The genus was proposed originally by Nuttall, but the taxonomic structure of the group was provided primarily by E.L. Greene in two short discussions (1894, 1906). Hall (1907) originally treated these plants as *Isocoma* but later (1928), in the only previous study of the whole group, submerged it as a section of *Haplopappus*. Some authors of floras of regions in the western United States have maintained the nomenclature in *Haplopappus*, but others (*e.g.*, Jepson 1925; Shinners 1950; Correll & Johnston 1970; Turner 1972) have accepted *Isocoma* as a separate genus. The study presented here is adjunct to the preparation of a treatment of *Isocoma* for the forthcoming "Asteraceae of México" by Turner & Nesom, since all but four of the species occur in México.

Hall considered *Isocoma* to be most closely related to *Hazardia* (*Haplopappus* sect. *Hazardia*). Clark (1979), however, placed *Hazardia* closest to species of *Haplopappus* sect. *Polyphyllus* in South America as well as to some species of *Machaeranthera* and *Xylorhiza*. While he speculated that *Hazardia brickellioides* (S.F. Blake) Clark, an anomalous element in the genus with $n = 6$ pairs of chromosomes, might represent a "distant link" to *Isocoma*, he summarized other opinions and affirmed that *Isocoma* is more closely related to other North American genera with a base chromosome number of $x = 6$. *Isocoma*, *Grindelia*, *Prionopsis*, *Xanthocephalum*, *Olivaea*, *Stephanodoria*, and the "*Haplopappus phyllocephalus* DC. group" form a group of closely related taxa (the "*Xanthocephalum* group;" Nesom, *et al.*, submitted). Within this group of species, Hartman & Lane (1991) have documented the occurrence of natural hybrids between the widely divergent *I. veneta* (Kunth) E. Greene and *X. humile* Benth. On the basis of chromosome number, morphological similarity, and artificially produced hybrids, Jackson (1966) and Jackson & Dimas (1981) considered the *H. phyllocephalus* group to be a part of *Isocoma* (as *Haplopappus* sect. *Isocoma*); Hartman (see 1990 for summary and other references) has considered the *H. phyllocephalus* group to be a separate genus, although he has not formalized this view, and it is also excluded from *Isocoma* in the present treatment. Compared to *Isocoma*, the former species are annual herbs with much broader, campanulate heads in a loosely associated capitulescence and achenes with nonresinous nerves.

Shinners inexplicably transferred *Aster palmeri* A. Gray (= *Ericameria austrotexana* M.C. Johnston) to *Isocoma*, where it is conspicuously anomalous, but that species is now included in the genus *Xylothamia* (Nesom, *et al.* 1990). Diploids and tetraploids have been reported in three species of *Isocoma* (*I. acradenia* [E. Greene] E. Greene, *I. plurifolia* [Torr. & A. Gray] E. Greene, and *I. menziesii* [Hook. & Arn.] Nesom, see references below), but the taxonomic significance of this, if any, has yet to be clarified.

The variation patterns and the taxonomy of *Isocoma* are most complex along the Pacific coast. In *I. menziesii* of that area, there are numerous intergrading forms to which names have been applied, and a more intensive and field oriented study may ultimately provide a more precise taxonomy for these plants. Many of the habitats of *I. menziesii*, however, have been eliminated by human expansion. With regard to the Californian plants of *Isocoma*, Hall (1907) noted that "Endless forms ... might be described from the abundant material at hand, but they could be characterized only by various combinations of characters well known to be inconstant." He referred all of these "endless forms" to two variable taxa of a single species (var. *vernonioides* (Nutt.) Jepson and var. *acradenia* [E. Greene] Hall of *I. veneta*) but subsequently (1928) recognized each as a different species. Other students of the Californian plants have recognized a number of varieties in each of two species, here identified as *I. acradenia* and *I. menziesii*.

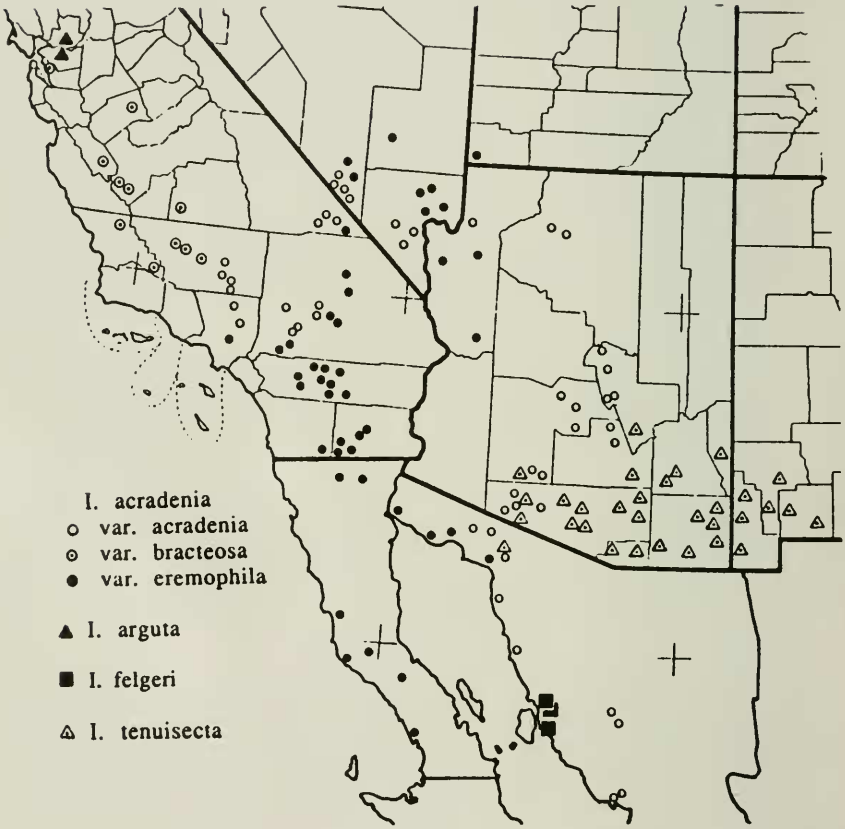
Most of the species of *Isocoma* have geographic ranges allopatric, or at least parapatric, with all others (i.e., only a single species is found in any given area), although correlated geological or topographic boundaries are difficult to discern (Maps 1-6). This is a remarkable phenomenon, the distribution maps giving the appearance of a closely fitted patchwork quilt. Exceptions to this are noted in the discussions following several of the species. The occurrence of hybrids at contiguous points of their geographic ranges are noted for a number of the species. In most instances it seems clear that species of *Isocoma* closely associated geographically also are most closely related to each other, but without further and more detailed study, the relatively few characters useful in distinguishing the taxa cannot support broader hypotheses regarding interspecific phylogenetic relationships.

Type specimens for new taxa named by E.L. Greene are divided for the most part between US and ND-G. Except where noted in the discussions below, those chosen as lectotypes bear an annotation by Greene as "Type." The species are treated in alphabetical order.

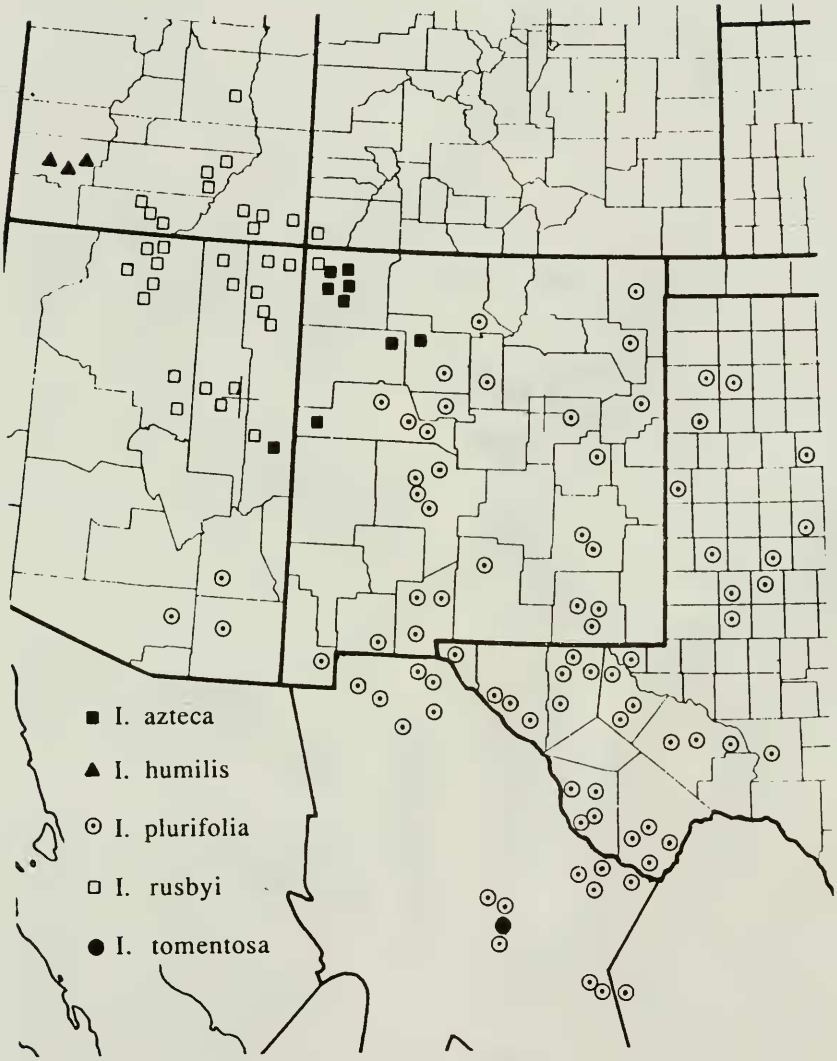
Isocoma Nutt., Trans. Amer. Phil. Soc., ser. 2, 7:320. 1840. TYPE: *Isocoma vernonioides* Nutt., Trans. Amer. Phil. Soc., ser. 2, 7:320. 1840. *Haplopappus* sect. *Isocoma* (Nutt.) Hall, Carnegie Inst. Washington Publ. 389:36. 1928.

(*H*)*Aplopappus* sect. *Aplodiscus* DC., *Prodr.* 5:350. 1836. LECTOTYPE (designated here): (*H*)*Aplopappus discoideus* DC. (= *Isocoma veneta* [Kunth] E. Greene). DeCandolle also included one other species in his sect. *Aplodiscus*: (*H*)*Aplopappus ramulosus* DC. (= *Baccharis pteronioides* DC.).

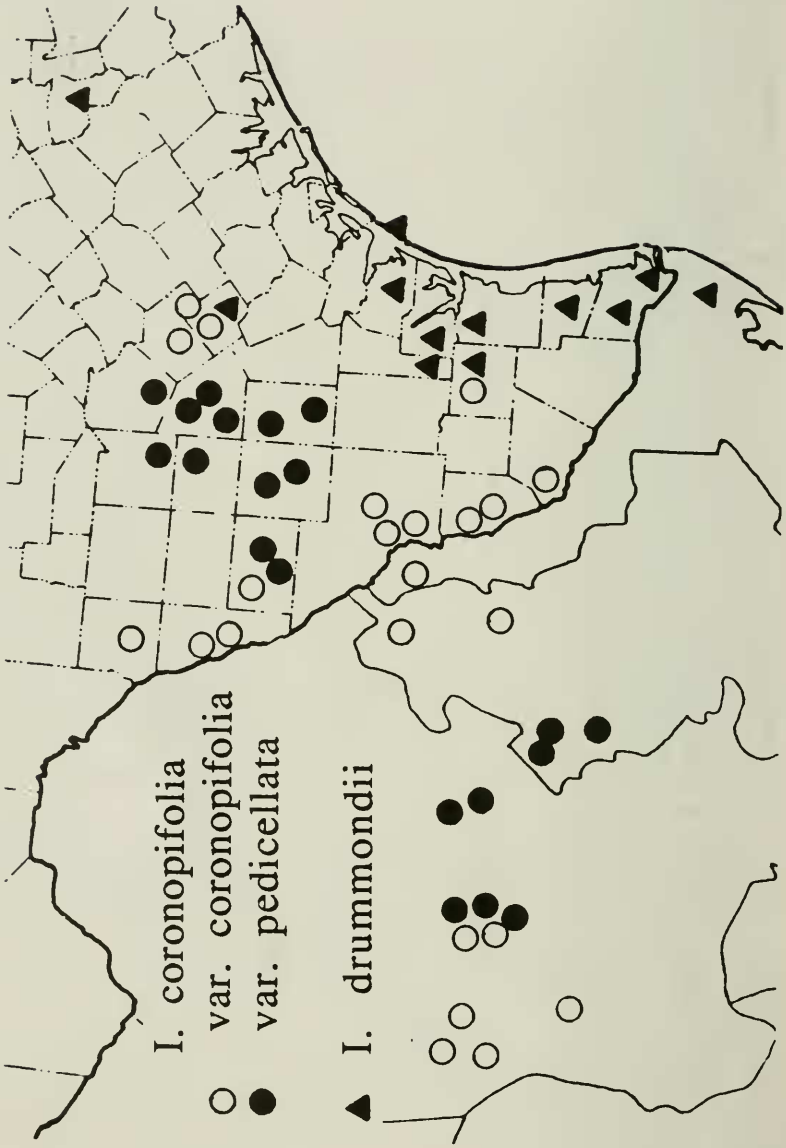
Perennial subshrubs from a woody base, often glutinous, the stems commonly erect and few branched, sometimes decumbent. Leaves primarily oblanceolate, entire or with spinulose tipped teeth or lobes, uninerved, glandular punctate to papillate or stipitate glandular, usually glutinous. Heads discoid, turbinate to campanulate, sessile to short pedicellate in terminal corymbs, rarely solitary; phyllaries strongly graduated; receptacle deeply alveolate, rarely shallowly so. Corollas yellow, narrow, abruptly ampliate, the tube with at least a few glandular hairs, the lobes erect, usually 0.5-1.8 mm long, the tube elongating at maturity and elevating the corolla at anthesis, outer corollas prominently bent or leaning outward; anthers inserted at midpoint in the tube; style appendages narrowly triangular. Achenes moderately to densely sericeous, broadly to narrowly turbinate, mostly 4-10 ribbed, the ribs sometimes very thick and resinous; pappus of numerous, thick, barbellate bristles of uneven length. Base chromosome number, $x = 6$.



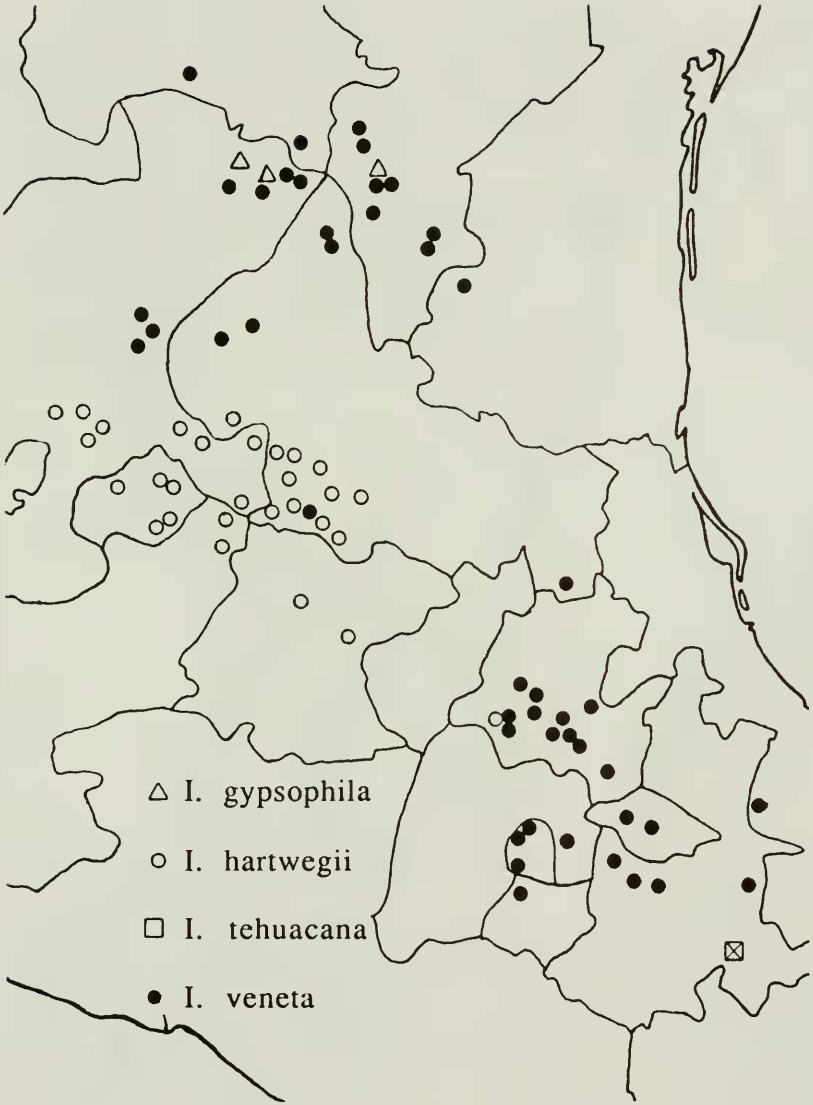
Map 1. Distribution of *Isocoma acradenia*, *I. arguta*, *I. felgeri*, and *I. tenuisecta*.



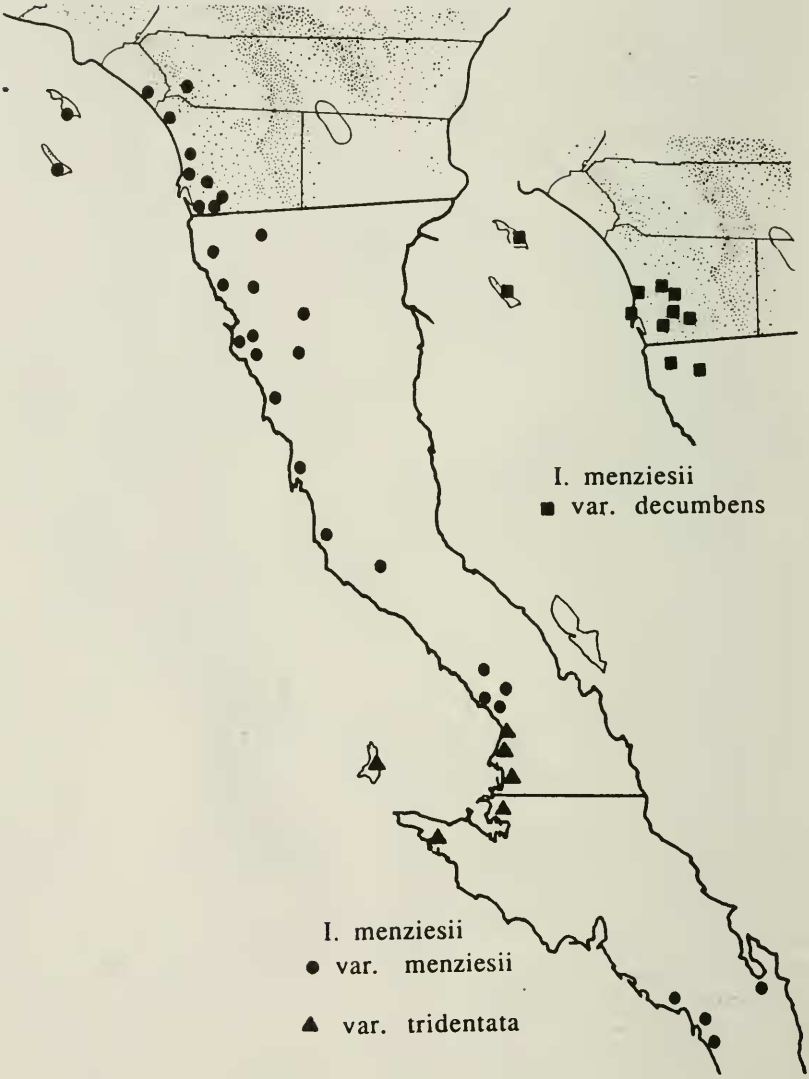
Map 2. Distribution of *Isocoma azteca*, *I. humilis*, *I. plurifolia*, *I. rusbyi*, and *I. tomentosa*.



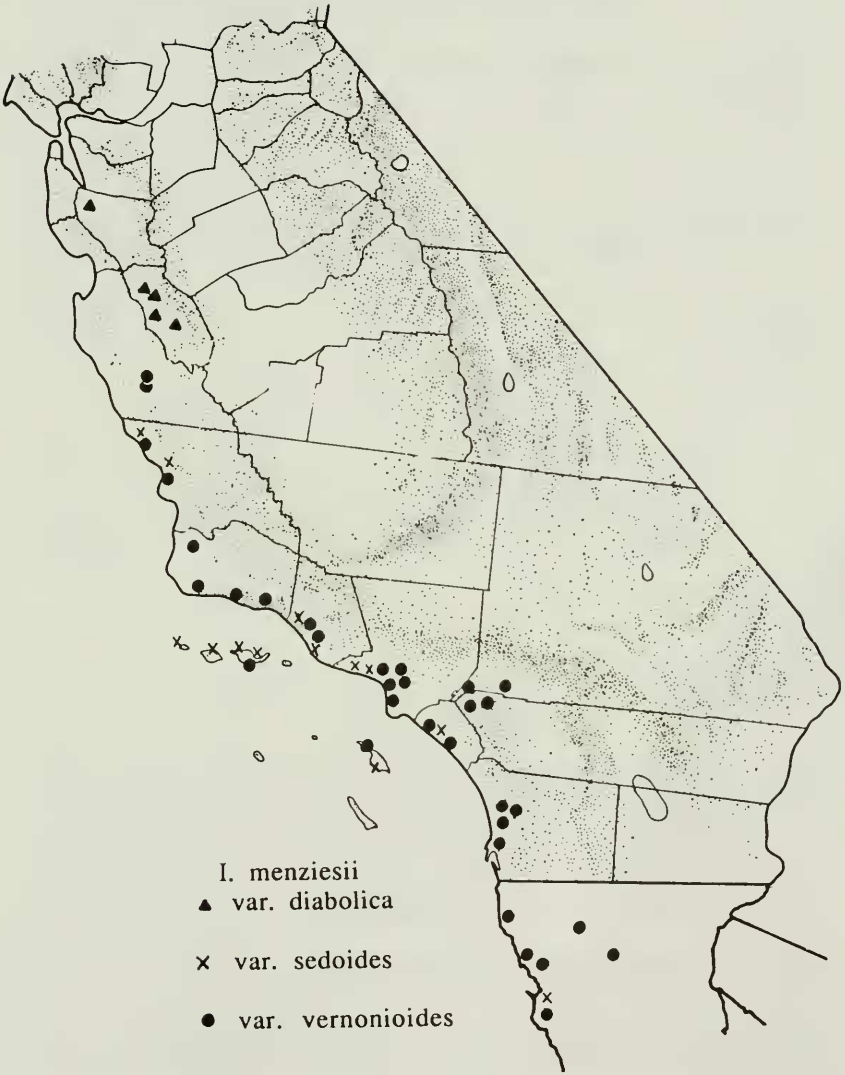
Map 3. Distribution of *Isocoma coronopifolia* and *I. drummondii*.



Map 4. Distribution of *Isocoma gypsophila*, *I. hartwegii*, *I. tehuacana*, and *I. veneta*.



Map 5. Distribution of *Isocoma menziesii* (var. *decumbens*, var. *menziesii*, and var. *tridentata*).



Map 6. Distribution of *Isocoma menziesii* (var. *diabolica*, var. *sedoides*, and var. *vernonioides*).

KEY TO THE SPECIES OF *ISOCOMA*

1. Plants of California (U.S.A.) and Baja California Norte and Sur (México). . ..... (2)

1′ Plants east of California, and Baja California Norte and Sur. ..... (6)

2. Phyllary apices with a strongly developed resin pocket. ..... (3)

2′ Phyllary apices punctate resinous but lacking resin pockets, or the pockets small and weakly developed if present. ..... (5)

3. Leaves entire or the lower shallowly serrate. ..... *I. acradenia*

3′ Leaf margins regularly toothed or lobed from base to apex. ..... (4)

4. Leaf teeth or lobes spinulose-tipped; heads 10-13 flowered; phyllary apices spinulose-aristate. ..... *I. arguta*

4′ Leaf teeth or lobes apically blunt; heads 12-20 flowered and the phyllary apices not spinulose-aristate, or heads 20-27 flowered and phyllary apices spinulose-aristate. ..... *I. acradenia*

5. Heads 10-13 flowered; phyllary apices distinctly aristate-spinulose. . ..... *I. arguta*

5′ Heads 15-28 flowered; phyllary apices not at all aristate or with a weakly developed, nonspinulose apical projection. . ..... *I. menziesii* (see key to varieties following species)

6. Phyllaries mostly obovate to ovate, the apex eglandular or punctate glandular but without a strongly developed resin pocket. ..... (8)

6′ Phyllaries narrowly oblong, the apex bearing a single, thick, subepidermal resin pocket nearly as wide as the phyllary or sometimes a large central pocket and 2-several, lateral, smaller ones. ..... (7)

7. Leaves pinnatifid, with linear lobes; corolla lobes cut 1/2 the length of the limb. ..... *I. felgeri*

7′ Leaves entire to toothed or lobed, not pinnatifid; corolla lobes cut 1/4-2/5 the length of the limb. ..... *I. acradenia*

8. Leaves narrowly oblong to oblanceolate-oblong or linear, the margins entire to shallowly toothed, not pinnatifid. ..... (~~13~~) 12

8′ Leaves pinnatifid. ..... (9)

9. Plants sometimes glandular but otherwise completely glabrous. .... (11)

9′ Plants minutely hispidulous or very sparsely puberulous, at least on the upper stems. ..... (10)

10. Heads 8-12 (-15) flowered; involucres 4.0-5.5 mm long, 2.0-2.8 mm wide; northern Sonora, Arizona, New México. ..... *I. tenuisecta*

10′ Heads 13-22 flowered; involucres 5.0-6.7 mm long, 4.0-5.0 mm wide; central México. ..... *I. hartwegii*

11. Heads 12-15 flowered, 2.5-4.0 mm wide; Texas and northeastern México (Coahuila, Nuevo León, Tamaulipas). ..... *I. coronopifolia*

11′ Heads 19-25 flowered, 5.0-7.5 mm wide; Arizona and New México. ..... *I. azteca*

12. Stems and leaves sparsely hispidulous to villosulous or tomentose; leaves prominently toothed. ..... (17)

12′ Plants glabrous or the leaves merely ciliate; leaves entire or very shallowly toothed near the apex. ..... (13)

13. Plants of New México, Arizona, Colorado, and Utah. ..... (16)

13′ Plants of Texas and northern México. ..... (14)

14. Heads 22-34 flowered, the involucres 4.5-5.5 (-7.0) mm wide, mostly 6.5-8.0 mm long. ..... *I. drummondii*

14′ Heads 8-15 flowered, the involucres 2.5-4.0 mm wide, mostly 4-6 mm long. ..... (15)

15. Leaves sometimes stipitate glandular but never glutinous, minutely hispidulous along the margins, sometimes on the lamina as well; involucres 4.0-5.2 mm long. ..... *I. plurifolia*

15′ Leaves never stipitate-glandular, almost always glutinous, completely glabrous; involucres 5-7 mm long. ..... *I. coronopifolia*

16. Leaves usually minutely ciliate, stipitate glandular or with sunken, papillate glands but not glutinous; heads (8-) 11-15 flowered, the involucres 4.0-5.2 mm long, 2.5-4.0 mm wide; corolla lobes 1.1-1.8 mm long, equaling the throat length; achenes 1.5-1.9 mm long, the ribs not apically "horned." ..... *I. plurifolia*

16′ Leaves eciliate, papillate or punctate, usually glutinous; heads 19-25 flowered, the involucres (5.5-) 6.0-9.5 mm long, 5.0-7.5 mm wide; corolla lobes 0.8-1.1 mm long, shorter than the throat; achenes 2.8-3.5 mm long, the resinous ribs extended into apical "horns." ..... *I. rusbyi*

17. Upper stems puberulent or hispidulous to nearly glabrous; heads in corymboid clusters; involucres 4-7 mm wide. ..... (19)

17′ Upper stems villous; heads solitary or rarely paired; involucres 6-9 mm wide. ..... (18)

18. Heads 30-40 flowered; involucres 7-9 mm wide; phyllaries with broad, scarious margins. ..... *I. gypsophila*

18′ Heads 19-28 flowered; involucres 6-7 mm wide; phyllaries with narrow scarious margins. ..... *I. humilis*

19. Stems leaves, and phyllaries puberulent-tomentose. ..... *I. tomentosa*

19′ Stems and leaves minutely hispidulous to short puberulent; phyllaries glabrous. ..... (20)

20. Stems and leaves densely short puberulent; involucres 6-7 mm wide; corolla tubes sparsely sericeous; achenes 2.8-4.0 mm long. ..... *I. tehuacana*

20′ Stems and leaves minutely hispidulous to nearly glabrous; involucres 4-5 mm wide; corolla tubes glabrous; achenes 1.6-2.8 mm long. ..... *I. veneta*

1. *Isocoma acradenia* (E. Greene) E. Greene

Small shrubs 0.6-1.5 m tall, with markedly whitish stems. Stems and leaves glabrous to minutely hispidulous. Leaves entire to pinnatifid or toothed, punctate papillate but rarely glutinous, often in axillary fascicles. Heads turbinate to narrowly obconic, 8-27 flowered; phyllaries narrowly oblong, glabrous or rarely somewhat papillate, yellowish white and indurated except for the greenish or brownish apex, the apex bearing a single, thick, subepidermal resin pocket nearly as wide as the bract, or sometimes a central pocket and 2-several, smaller, lateral ones. Corollas 5-7 (-8) mm long. Achenes 8-10 ribbed, (2.0-) 3.0-3.5 (-4.0) mm long. Chromosome numbers, $n = 6$, 12 pairs (see below).

Isocoma acradenia is distinctive in its whitish stems and narrow, whitish indurated, phyllaries with an apical resin pocket (or pockets). Three intergrading varieties can be recognized.

Key to the varieties

1. Heads 20-27 flowered; phyllary apices spinulose-aristate. .. var. *bracteosa*

1′ Heads 8-20 flowered; phyllary apices usually rounded and not at all spinulose, sometimes with weakly developed aristae. .....(2)

2. Leaves entire, rarely the lower toothed or lobed; heads 8-18 flowered. . ..... var. *acradenia*

2′ All leaves toothed to pinnatifid; heads 12-20 flowered. . ..... var. *eremophila*

a. Var. *acradenia*

Isocoma acradenia (E. Greene) E. Greene var. *acradenia* BASIONYM: *Bigelovia acradenia* E. Greene, Bull. Torrey Bot. Club 10:126. 1883. LECTOTYPE (designated here): UNITED STATES. California: Mohave Desert, 6 Sep 1881, *E. Greene s.n.* (ND-G!; Isolectotypes: CAS, GH!). *Aster acradenius* (E. Greene) O. Ktze., *Rev. Gen.* 318. 1891. *Isocoma veneta* (Kunth) E. Greene var. *acradenia* (E. Greene) Hall, Univ. California Publ. Bot. 3:64. 1907. *Haplopappus acradenius* (E. Greene) S.F. Blake, Contr. U.S. Natl. Herb. 25:546. 1925. The ND-G specimen, a duplicate *ex* CAS, is annotated by Greene as *Bigelovia acradenia* Greene but not specifically as the "Type."

Isocoma limitanea Rose & Standl., Contr. U.S. Natl. Herb. 16:18. 1912. TYPE: MÉXICO. Sonora: village of Sonoyta, 14 Nov 1907, *D.T. MacDougal 14* (HOLOTYPE: US!).

Leaves 2-3 cm long, entire, or sometimes in Arizona the lower toothed or lobed. Heads 8-18 flowered, the involucres 5-7 mm high; phyllaries not spinulose-aristate. Achenes 2.0-2.4 mm long. Putative differences between this and var. *eremophila* (E. Greene) Nesom in head size and flower number do not hold, although both range larger in var. *eremophila.* Chromosome number, $n = 12$ pairs (Raven, *et al.* 1960; Urbatsch 1974).

Mojave Desert of California, adjacent Nevada, and Arizona, coastal Sonora; most commonly in salt shrub communities, often with *Larrea*, 650-1100 m; (June-) September-November.

See comments regarding putative intermediates with *Isocoma tenuisecta* E. Greene following that species.

b. Var. *bracteosa* (E. Greene) Nesom, *comb. nov.*

Isocoma acradenia (E. Greene) E. Greene var. **bracteosa** (E. Greene) Nesom. BASIONYM: *Isocoma bracteosa* E. Greene, Leafl. Bot. Observ. Crit. 1:170. 1906. LECTOTYPE (designated here): UNITED STATES.

California: Tulare Co., 27 Aug 1889, *C.S. Sheldon* (US!). *Haplopappus acradenius* (E. Greene) S.F. Blake subsp. *bracteosus* (E. Greene) Hall, Carnegie Inst. Washington Publ. 389:233. 1928. *Haplopappus acradenius* (E. Greene) S.F. Blake var. *bracteosus* (E. Greene) McMinn, *Illustr. Man. Calif. Shrubs* 574. 1939.

Lower leaves usually shallowly toothed, those on the upper (10-) 15-20 cm of the stem spreading to slightly deflexed, mostly 5-15 mm long, entire to serrulate. Heads 20-27 flowered, the involucres 7-8 mm high; phyllaries distinctly spinulose-aristate at the apex. Achenes 2.5-3.0 mm long. Chromosome number, $n = 6$ pairs (Raven, *et al.* 1960).

California, at the northwestern portion of the range of the species, primarily in the San Joaquin Valley, but extending, at least historically, to San Francisco (see comments below); August-October.

Var. *bracteosa* (E. Greene) Nesom comprises a geographically and morphologically distinct group of populations within *Isocoma acradenia*. Compared to var. *acradenia*, to which it is geographically adjacent, var. *bracteosa* has heads with a greater number of flowers and phyllaries with spinulose-aristate apices. The putative distinction regarding distribution and sizes of cauline leaves, emphasized in previous treatments, is not at all consistent, since many plants of var. *acradenia* are habitally identical to those of var. *bracteosa*. The two varieties differ in relatively few features, but intermediates between them apparently are rare in the zone of contact.

A collection from the "Bay of San Francisco," made by the Wilkes Expedition (no. *1668*, NY, US) has been annotated and mapped as var. *bracteosa*, but in their few flowered (13-14) heads and more extensively chlorophyllous phyllary apices, they are more like *Isocoma arguta* E. Greene. They have entire leaves, however, and cannot be placed with the latter species.

c. Var. *eremophila* (E. Greene) Nesom

Isocoma acradenia (E. Greene) E. Greene var. **eremophila** (E. Greene) Nesom. BASIONYM: *Isocoma eremophila* E. Greene, Leafl. Bot. Observ. Crit. 1:170. 1906. LECTOTYPE (designated here): UNITED STATES. California: San Diego Co., southwestern part of the Colorado Desert, 1 Nov 1890, *C.R. Orcutt 2223* (US!; Isolectotype: GH!). *Haplopappus acradenius* (E. Greene) S.F. Blake subsp. *eremophilus* (E. Greene) Hall, Carnegie Inst. Washington Publ. 389:233. 1928. *Haplopappus acradenius* (E. Greene) S.F. Blake var. *eremophila* (E. Greene) Munz, *Man. S. Calif.* 523. 1935. *Isocoma acradenia* (E. Greene) E. Greene subsp. *eremophila* (E. Greene) Beauchamp, Phytologia 59:437. 1986.

Leaves mostly 2.5-5.0 cm long, pinnatifid to pinnately toothed with 2-4 (-5) pairs of narrow lobes or teeth. Heads 12-20 flowered, the involucres 6-8 mm high, phyllary tips with a resin pocket or sometimes merely glandular-papillate but swollen, not spinulose aristate. Achenes 3.5-4.0 mm long. Chromosome number, $n = 6$ pairs (De Jong & Montgomery 1963).

Baja California Norte, northwestern Sonora, southern California, southwestern Arizona, southern Nevada, Utah(?); sandy soil, alkaline or salt flats, desert dunes, often with Saguaro-*Prosopis-Larrea*, *Larrea*, *Atriplex*, *Yucca*, *Pachycereus*, or mixed scrub; (-15-) 0-900 (-1050) m; (May-) August-November (-December). A single collection of *Isocoma acradenia* var. *eremophila* is labeled as having been made in Utah (no other locality data, 1870, *Palmer 21*-GH, US), but this species has not been recorded from Utah in more recent floristic treatments.

Var. *eremophila* is distinguished from var. *acradenia* by its shallowly lobed to serrate crenate leaves. More strongly pinnatifid leaved plants occur along the coast of northeastern Sonora as well as in northwestern Arizona and scattered in southern California. For the most part, the two varieties are clearly separated in geography; plants in the apparently isolated system of var. *eremophila* in Nevada do not differ from others in the range. In some areas (*e.g.* in southwestern Nevada), intergradation between var. *eremophila* and var. *acradenia* appears to be nearly complete, but in others (*e.g.* western San Bernadino Co., particulary southeast of Barstow) the two morphological forms appear to be contiguous with little or no intergradation. In the latter area, each of the two varieties has been reported at a different ploidy level.

In the area around Dixieland (Imperial Co., California) there is a distinctive population system of var. *eremophila* with heads borne on long pedicels. In a few plants of otherwise typical morphology scattered through the range, the resin pockets characteristic of the phyllary apices may be reduced or absent, the apices appearing merely punctate glandular, though often still remaining thickened. These are particularly common in Riverside Co. in the area of Hemet and San Jacinto. The plants from northwestern Sonora consistently tend to have less strongly developed resin pockets and are also similar in their linear leaves to the putative intermediates between var. *acradenia* and *Isocoma tenuisecta* (see discussion following the latter).

2. *Isocoma arguta* E. Greene

Isocoma arguta E. Greene, *Man. Bot. San Franc. Bay Reg.* 175. 1894. LECTOTYPE: UNITED STATES. California: Solano Co., Morning Light, ["subsaline plains east of the Vaca Mountains," in the protologue] 16 Sep 1891, *W.L. Jepson s.n.* (ND-G!; Isolectotypes: JEPS, US-2 sheets!; Probable isolectotype [without collection data]: ND-G!). *Isocoma veneta*

(Kunth) E. Greene var. *arguta* (E. Greene) Jepson, *Fl. W. Mid. Calif.* 500. 1901. *Haplopappus venetus* (Kunth) S.F. Blake var. *argutus* (E. Greene) Keck, Aliso 4:103. 1958. Neither the US nor ND-G specimens is specifically marked as "Type."

Shrubs 1-3 dm tall, glabrous or the stems lightly villous near the very base. Leaves mostly 1.0-2.5 cm long, 3-7 mm wide, only slightly reduced in size upwards, serrate to pinnatifid with 3-5 pairs of aristate teeth or lobes arranged from base to apex, viscid, glabrous to minutely hispidulous and stipitate glandular. Heads short pedicellate in dense clusters, 10-13 flowered, turbinate with a narrowly acute base, the involucres 5-7 mm high, 4-5 mm wide; phyllaries glutinous, with a sharply demarcated, densely punctate and thickened apical area (sometimes as a small resin pocket), spinulose-aristate at the apex, the lower 2/3-3/4 white indurated; receptacles with short, triangular alveoli with filiform apices. Corollas 4.0-5.0 mm long, the lobes deltate, 0.4-0.5 mm long. Achenes 3.0-3.5 mm long, densely sericeous, with ca. 6-8 resinous ribs.

California, apparently localized in Solano and Contra Costa counties; low hills, subsaline plains; August-October.

Isocoma arguta is distinctive in its short stature, glabrous, small, thickened, regularly toothed to short lobed leaves, few flowered heads, and narrowly oblong or obovate, white indurated phyllaries with small, sharply defined apical areas and spinulose-aristate tips. It has been treated as a variety of *I. menziesii*, but it is clearly more similar to *I. acradenia* var. *bracteosa* in its phyllary morphology. Further, in its inland distribution, *I. arguta* is geographically more similar to and nearly continuous with *I. acradenia*, adding a northern segment above the range of var. *bracteosa*. The plants of *I. arguta*, however, are consistent in their morphology, different from those of var. *bracteosa* in their leaf size and margins and their fewer flowered heads; plants that could be considered intermediate with any other taxon have not been observed.

3. *Isocoma azteca* Nesom.

Isocoma azteca Nesom, *sp. nov.* TYPE: UNITED STATES. New Mexico: McKinley Co., 3.4 mi by road SW of Ojo Encino on slopes below NE-facing "badlands," 11 Aug 1976, *R. Spellenberg, et al. 4344* (HOLOTYPE: TEX!; Isotypes: NMC!, NY!).

Isocomae rusbyi E. Greene similis sed foliis pinnatisectis differt.

Shrubs 2-4 dm tall, forming clumps up to 6 cm wide. Stems glabrous, yellowish green to whitish, rarely slightly villous. Leaves glabrous, punctate, slightly resinous, 2-5 cm long, 4-12 mm wide, narrowly oblong to narrowly oblanceolate, shallowly to deeply pinnatifid with 3-8 pairs of aristate tipped

lobes evenly arranged from base to apex. Heads campanulate, basally rounded, 18-23 flowered, the involucres 7-8 mm high, 5-7 mm wide; inner phyllaries with broad scarious margins, the apices green, barely to prominently punctate. Corollas 5-6 mm long, the tube 3.0-3.5 mm long, the lobes triangular, 0.7-1.0 mm long. Achenes 2-4 mm long, with 5-8 thick resinous ribs, forming small "horns" at the apex, densely sericeous. Chromosome number, $n = 6$ pairs (Jackson 1959, as *Haplopappus hartwegii* [A. Gray] E. Greene).

Northeastern Arizona and northwestern New Mexico; river edges, slopes, sandy to clay soil, gypseous or saline, commonly with *Atriplex*, badlands in pinyon pine-juniper woodlands; 1500-1800 m; July-September.

Additional collections examined: UNITED STATES. Arizona: Apache Co., northeastern Arizona (Moki Reservation) and Little Colorado River, 1 Aug-5 Sep 1896, *Hough 114* (US); Apache Co., Hopi Ind. Res., 5000 ft, 7 Aug 1937, *Whiting 854/2693* (ARIZ). New Mexico: Cibola Co. [labeled Valencia Co.], extreme W part of the county, near the Arizona border, 16 Aug 1983, *McIntosh s.n.* (NY); San Juan Co., Botanical Station, Gallegos Wash, Horn Canyon Quadrangle, 5340 ft, deep sand at edge of wash, 24 Jul 1974, *Blankenhorn 89B* (ARIZ); San Juan Co., 10 mi S of area complex, Navajo Mine, 4 Corners Power Plant, 16 Aug 1986, *Kass 2567* (NY); San Juan Co., Navajo Project area 13 mi S of Farmington, 6000 ft, 28 Jul 1978, *Pase 2328* (TEX); San Juan Co., 5.5 mi by road S of Bisti, first draw S of De-na-zin Wash, 5840 ft, 20 Aug 1976, *Reitzel & McKinney 4390* (NMC, NY); San Juan Co., flood plain of Chaco River ca. 7 mi SE of Shiprock, 9 Sep 1977, *Spellenberg 4856* (NMC, NY, TEX); San Juan Co., ca. 17 mi S of Fruitland, 15 mi NNE of Burnham Trading Post, in Cottonwood Arroyo at Cottonwood Springs, 10 Sep 1977, *Spellenberg 4870* (NMC, TEX); San Juan Co., ca. 10 air mi SE of Shiprock, E side of Hogback near S end of 1st ridge S of San Juan River, clay soil, 10 Aug 1981, *Spellenberg & Ward 6091* (NMC, NY); San Juan Co., 6 mi N of Farmington, 1 mi S of Jackson Lake, W of Hwy 170, 26 Jul 1977, *Welsh, et al. 15645* (NY).

The plants from Cibola Co., New Mexico (*McIntosh s.n.*) are atypical in their vestiture (stems lightly villous and leaves minutely stipitate glandular) but they are otherwise typical of *Isocoma azteca* Nesom.

On the labels of his collection *4856* of *Isocoma azteca*, Richard Spellenberg noted that there were "nearly entire-leaved to (more commonly) pinnatifid-leaved plants" at the single locality, and examples of both morphological forms are mounted on each of the three duplicate sheets cited above. The branches, however, bear either nearly entire leaves or deeply pinnatifid ones, and intermediates, if present at all, must have been less common than these two extremes in morphology. As interpreted here, the population at this locality comprises individuals of both species, which meet there at the margin of each of their geographic ranges (Map 2). In Apache Co., Arizona, typical plants of both species have been collected in relatively close proximity (*I. rusbyi* E.

Greene at Tanner's Crossing of Little Colorado, 13 Nov 1899, *Ward* 7-US; *I. azteca*, *Hough 114*). One plant of *I. rusbyi* with few lobed lower leaves (the upper entire) has been collected near the western edge of its geographic range (Coconino Co., near Tuba, 15-31 Jul 1920, *Clute 120*-NY), but all other plants studied have completely entire leaves. Should further collections demonstrate that a broader area of intermediates exists between these two taxa, they may be combined into a single species. See additional comments regarding possible intermediates with *I. plurifolia* following that species.

The relationship of *Isocoma azteca* to *I. rusbyi* appears to be analogous to that of *I. hartwegii* to *I. veneta*. In both cases, the two taxa appear to be sister species but each member of the pair has a sharply defined geographic range, allopatric or parapatric with its close relative, and few if any intermediates are formed between them. The relationship of *I. acradenia* var. *acradenia* (with entire leaves) to var. *eremophila* (with toothed to pinnatifid leaves), that of *I. menziesii* var. *menziesii* to var. *vernonioides* (Nutt.) Nesom, and that of *I. coronopifolia* (A. Gray) E. Greene var. *pedicellata* (E. Greene) Nesom to var. *coronopifolia* is also similar to that of *I. rusbyi* to *I. azteca*. In each of these three pairs of taxa, however, there is considerable intergradation between them, at least along part of their contiguous ranges, and the rationale for maintaining them as separate species is weakened accordingly.

4. *Isocoma coronopifolia* (A. Gray) E. Greene

Shrubs 0.3-1.2 m tall. Leaves pinnatifid with 1-3 pairs of spreading, linear, spinescent tipped lobes, less commonly entire or only the lowermost leaves pinnatifid, the blade 1.5-3.0 (-5.0) cm long, 0.5-2.0 (-2.5) mm wide, glutinous, completely glabrous, somewhat fleshy and drying with a characteristic "alligator skin" pattern. Heads 12-15 flowered, usually narrowly cuneate at the base, the involucres 5.0-6.0 (-7.0) mm long, 2.5-4.0 mm wide (pressed); phyllary apex markedly thickened, somewhat glandular, thickened, rarely punctate, tips of the innermost mostly flat and not glandular; receptacles with lanceolate alveoli. Corollas 4.5-6.0 mm long, the tube 2.5-3.5 mm long, lobes 0.8-1.0 mm long, 1/3-2/5 the length of the limb. Achenes 1.8-2.2 mm long, with 4-6 resinous ribs, sometimes with additional, interspersed, thinner nerves, lightly sericeous. Chromosome number, $n = 6$ pairs (Turner, Powell, & Watson 1973, as *I. heterophylla* [A. Gray] E. Greene; Urbatsch 1975; Powell & Powell 1977, 1978).

Chihuahua?, Coahuila, Tamaulipas, Nuevo León, and Texas; gypsum or alkaline flats, calcareous substrate (Texas), dunes or sandy habitats, matorral or shrublands; 250-1100 m; (May-) June-October. The single collection of this species attributed to Chihuahua (var. *coronopifolia*, *Schott s.n.* - US) has no locality data other than "roadside." Map 3 shows the ranges of the two varieties, which are essentially similar in habitat.

Key to the varieties of *I. coronopifolia*

1. At least the upper leaves entire. ..... var. *pedicellata*

1′ All leaves pinnatifid. ..... var. *coronopifolia*

a. Var. *coronopifolia*

Isocoma coronopifolia (A. Gray) E. Greene var. *coronopifolia*. BASIONYM: *Linosyris coronopifolia* A. Gray, *Pl. Wright.* 1:96. 1852. TYPE: UNITED STATES. Texas: [Kinney Co., probably at Brackettville], Sep 1849, *C. Wright 289* (HOLOTYPE: GH!, NY-photo!, US-photo!); not (*H*)*Aplopappus coronopifolius* DC., 1836. *Bigelovia coronopifolia* (A. Gray) A. Gray, Proc. Amer. Acad. Arts 8:638. 1873. *Isocoma coronopifolia* (A. Gray) E. Greene, Erythea 2:111. 1894.

b. Var. *pedicellata* (E. Greene) Nesom.

Isocoma coronopifolia (A. Gray) E. Greene var. **pedicellata** (E. Greene) Nesom, *comb. et stat. nov.* BASIONYM: *Isocoma pedicellata* E. Greene, Leafl. Bot. Observ. Crit. 1:170. 1906. LECTOTYPE (designated here): UNITED STATES. Texas: [LaSalle Co.], "Guadaloupe, a mail station 105 mi SW of San Antonio," 17-18 Apr 1879, *E. Palmer 486* (US!; Isolectotypes: GH!, NY!, US!).

Plants of *Isocoma coronopifolia* with entire leaves on at least the upper parts of the stems occur in two separate regions within the range of the species (Map 3). Although it is not clear whether or not these entire leaved population systems have arisen independently, they are sharply distinct from the typical plants with all leaves nearly pectinately dissected. For consistency with other infraspecific taxa within the genus with analogous variation in leaf morphology (see comments following *I. azteca*), the two are treated here as separate varieties. Plants with pinnatifid leaves on the lower parts of the stems and entire ones on the upper parts occur in both regions and are perhaps genetically intermediate, but they are mapped as var. *pedicellata*.

Entire leaved plants of *Isocoma coronopifolia* (var. *pedicellata*) can be distinguished from *I. plurifolia* by their fleshy, completely glabrous and differently textured leaves with narrower blades, longer involucres, and their more shallowly cleft corolla lobes. The two taxa do not come into geographical contact, and there is no evidence of intergradation between them, although some forms of each may be superficially very similar. In Brooks Co., Texas, *I. coronopifolia* var. *coronopifolia* has been noted in label data as "growing with and distinct from" *I. drummondii* (Torr. & A. Gray) E. Greene (4 mi S of Falfurrias, *Johnston 541482*-TEX).

5. *Isocoma drummondii* (Torr. & A. Gray) E. Greene

Isocoma drummondii (Torr. & A. Gray) E. Greene, Erythea 2:111. 1894. BASIONYM: *Linosyris drummondii* Torr. & A. Gray, *Fl. N. Amer.* 2:233. 1842. TYPE (probable holotype): UNITED STATES. Texas: [Austin Co.?, San Felipe–see comments below], 1833-34, *T. Drummond 223* (GH not located, GH-photo!; Duplicate: K). *Bigelovia drummondii* (Torr. & A. Gray) A. Gray, Proc. Amer. Acad. Arts 8:639. 1873. *Aster berlandieri* O. Ktze., *nom. nov.*, *Rev. Gen.* 318. 1891. *Chondrophora drummondii* (Torr. & A. Gray) Heller, Contr. Herb. Franklin & Marshall College 1:101. 1895. (*H*)*Aplopappus drummondii* (Torr. & A. Gray) S.F. Blake, Contr. U.S. Natl. Herb. 23:1491. 1926. The GH specimen cited by Hall (1928), and photographed, was not relocated in the present study.

Isocoma megalantha Shinners, Field & Lab. 23:24. 1955. TYPE: UNITED STATES. Texas: Karnes Co., 1.3 mi SE of Harmony School, 26 Nov 1954, *J.C. Johnson 1638* (HOLOTYPE: SMU!; Isotypes: NY!, TEX!).

Shrubs ca. 0.5-1.0 m tall, completely glabrous, glutinous. Leaves narrowly oblong to oblanceolate oblong, 2.0-4.5 mm wide, 1.3-5.0 cm long, entire or less commonly with 1-3 pairs of shallow teeth. Heads 22-34 flowered, campanulate with rounded base, the involucres (5.5-) 6.5-8.0 mm long, 4.5-5.5 (-7.0) mm wide; apices of phyllaries rounded to obtuse, with a sharply demarcated and strongly glandular punctate apical area ca. 1/3-1/2 the phyllary length; receptacles weakly to strongly developed, triangular alveoli. Corollas 5.8-7.5 mm long, the lobes triangular, 0.8-1.0 mm long. Achenes 2.0-2.8 (-4.0) mm long, very lightly sericeous, with 6-9 thin, sometimes whitish ribs, these not forming apical horns. Chromosome number unknown.

Southern Texas and immediately adjacent northeastern Tamaulipas; coastal habitats, brushy prairie, scrub woods, often with mesquite, sand or clay, sometimes on beach dunes; 0-20 m; (March-) May-July.

According to Hall (1928), one of Drummond's collections of this species at K carries the notation "San Felipe," but I have neither seen more recent collections from this area nor personally been able to relocate the species there, which is apparently considerably to the northeast of its primary range (the presumed type locality shown on Map 2). Drummond also collected at other sites in southeastern Texas (Geiser 1948), and it is likely that the type locality was further southwest and nearer the coast than San Felipe. Similarly, attempts to relocate populations in the area of the type locality of *Isocoma megalantha* Shinners have been unsuccessful, as the plants there apparently have been extirpated by agriculture.

Isocoma drummondii has sometimes been considered to include *I. rusbyi*, but the latter is widely separated from *I. drummondii* in range and has some-

what smaller heads with shorter corollas and larger, more densely pubescent achenes with much thicker, resinous ribs. In its somewhat fleshy leaves, and achene morphology, *I. drummondii* is more similar to the geographically adjacent *I. coronopifolia* (var. *coronopifolia*, with divided leaves).

6. *Isocoma felgeri* Nesom.

Isocoma felgeri Nesom, *sp. nov.* TYPE: MÉXICO. Sonora: 5 mi by road E of town of Bahía Kino, crest of slight rise in desert flat, sandy soil, cactus scrub with *Pachycereus pringlei*, 19 Oct 1963, *R.S. Felger 9051* (HOLOTYPE: TEX!; Isotypes: ARIZ!, GH!, MEXU!).

Isocomae acradeniae (E. Greene) E. Greene similis morphologia phyllariis sed foliis profunde pinnatisectis lobis linearibus et lobis corollarum longioribus differt.

Shrubs 0.5-1.2 m tall. Stems and leaves glutinous, sparsely and minutely hispidulous. Leaves mostly 1.5-3.5 cm long, deeply pinnatisect, with the central portion and lobes linear to linear oblanceolate, 3-12 mm long, strongly divergent, in 1-2 pairs mostly near the apex. Heads sessile to short pedicellate in terminal clusters, 3.5-5.0 mm wide, 8-11 flowered; phyllaries strongly graduated in 4-5 series, white indurated thickened, all except the inner with a sharply delimited, apical resin pocket, the innermost 4.0-5.5 mm long, with thin hyaline margins and an acute apex, the outer oblong with a rounded apex. Corollas 4.5-5.5 mm long, the tube 2.5-3.5 mm long, the lobes triangular, 1.0-1.5 mm long, ca. half the length of the limb. Achenes ca. 2 mm long, with 5-6 resinous ribs, densely sericeous. Chromosome number unknown.

Additional collections examined: MÉXICO. Sonora: 8 mi by road E of village of Bahía Kino, nearly flat desert plain, sandy soil, cactus scrub with *Pachycereus pringlei*, 29 Jan 1964, *Felger 9841* (ARIZ, MEXU, NY, TEX); 8.9 mi by road E of Bahía Kino (village), desert plain, "cardonal" cactus scrub with *Pachycereus pringlei* and dense cover of ephemeral forbs and grasses, 17 Dec 1966, *Felger 15206* (ARIZ, MEXU, TEX); 5.1 mi by road NE of town of Bahía Kino, low saline flats with silty soil, near sea level, cactus scrub, 19 Dec 1966, *Felger 15285* (ARIZ, MEXU, TEX, US); desemboque del Río de la Concepción, vicinity 30° 33′ N, 113° 00′ W, desert scrub in high shifting beach dunes, locally common, 27 Dec 1967, *Felger 16781* (ARIZ, ENCB, GH, MEXU, NY, TEX, UC, US).

Isocoma felgeri Nesom appears to be endemic to the area around Bahía Kino along the coast of Sonora. The plants are similar to *I. acradenia* in their oblong, whitish, indurated thickened phyllaries, each with a sharply delimited resin pocket at the apex, but plants of *I. acradenia* have neither such deeply

cut corolla lobes nor similarly dissected leaves. *Isocoma tenuisecta* has similar corollas but a much denser vestiture and its phyllaries typically lack the strongly defined resin pockets. *Isocoma acradenia* var. *eremophila* also has pinnately toothed or lobed leaves but the leaf segments are much broader, although a few collections with narrow, short lobes have been made from the north end of the Gulf of California. Var. *acradenia* occurs sporadically along the coastal region of Sonora to near Games and has been collected near Bahía Kino, apparently completely surrounding the range of *I. felgeri*. Plants of var. *acradenia*, however, produce entire, narrowly obovate leaves, although the heads are of nearly the same size as *I. felgeri*. The new species is named for Dr. Richard Felger, its sole collector and a relentless explorer of arid habitats in the southwestern United States and adjacent México.

7. *Isocoma gypsophila* B. Turner

Isocoma gypsophila B. Turner, Sida 5:24. 1972. TYPE: MÉXICO. Nuevo León: 15 mi S of San Roberto Junction, *B.L. Turner 6213* (HOLOTYPE: TEX!; Isotype: NY!).

Similar to *Isocoma veneta* and occurring sympatrically in the northernmost portion of its range, but different in its smaller stature, villosulous upper stems, solitary (or rarely double) and larger heads with 30-40 flowers (the involucres 6-7 mm long, 7-9 mm wide), and its broader inner and outer phyllaries with broad, translucent margins and green, barely glutinous, apical portions; receptacles with short, lacerate-lanceolate alveoli. Chromosome number, $n = 6$ pairs (Turner 1972).

Local in Nuevo León and adjacent northern Zacatecas; saline flats in gypseous soil, hills, with other gypsophilous subshrubs and mesquite, juniper, opuntia; 1600-1800 m; August-October.

In the original description Turner noted that typical *Isocoma veneta* occurred at the type locality intermixed with plants of *I. gypsophila* B. Turner. Plants of *I. gypsophila* from Zacatecas are large headed with villous vestiture, but the heads are sometimes paired rather than solitary. All collections examined for this relatively poorly known species are cited here: MÉXICO. Nuevo León: topotype, 6 Aug 1971, *Reveal 2655* (GH, LL). Zacatecas: no other data, 1908, *Lloyd 19* (GH, US); hills near Cedros, 30 Oct 1907, *Lloyd & Kirkwood 148* (GH); E of San Juan de los Cedros, ca. 35 mi W of Mex Hwy 54 near Concepción del Oro, 22 Sep 1973, *Reveal 3361* (GH, NY, TEX, US).

8. *Isocoma hartwegii* (A. Gray) E. Greene

Isocoma hartwegii (A. Gray) E. Greene, Erythea 2:111. 1894. BASIONYM: *Bigelovia hartwegii* A. Gray, *Synopt. Fl. N. Amer.* 1(2):143. 1884. LECTOTYPE (selected by McVaugh 1984): MÉXICO. Jalisco: Lagos, *Hartweg 114* (K, NY-photo!; Isotype: GH according to Hall 1928, but not relocated in the present study). *Aster hartwegii* (A. Gray) O. Ktze., *Rev. Gen.* 318. 1891. (*If*)*Aplopappus hartwegii* (A. Gray) S.F. Blake, Contr. U.S. Natl. Herb. 23:1492. 1926. *Haplopappus venetus* (Kunth) S.F. Blake var. *hartwegii* (A. Gray) McVaugh, Contr. Univ. Michigan Herb. 9:364. 1972.

Subshrubs, at least the upper stems, but commonly stems and leaves, minutely hispidulous to stiffly puberulous. Leaves oblanceolate, usually narrowly so, pinnatifid with 1-4 pairs of slender lobes, 5-20 mm long, the blades 0.5-1.5 (-2.0) mm wide, 2-8 mm wide from lobe tip to tip, 8-20 times longer than wide. Heads 13-22 flowered, broadly turbinate to campanulate, rounded at base, the involucres 5-7 mm high, 4-5 mm wide; phyllaries greenish, barely thickened at the apex, sometimes gland-dotted, without prominent scarious margins; receptacles strongly triangular-alveolate. Corollas 4.5-6.0 mm long, the tube 2.0-3.0 mm long, the lobes deltate to deltate-triangular, 0.6-1.0 mm long, 1/4-1/3 the length of the limb. Achenes broadly turbinate, 1.3-2.3 mm long, densely short sericeous, with 4-6 low, broad, resinous ribs. Chromosome number, $n = 6$ pairs (Jackson & Dimas 1981, as *Haplopappus venetus* [Kunth] S.F. Blake).

Zacatecas, San Luis Potosí, Aguascalientes, Jalisco, Guanajuato, and Hidalgo; gravelly or sandy loam, low hills, saline alluvium, clay flats, or over limestone, gypsum, sandstone, or rhyolite, *Larrea-Prosopis*, matorral; 1800-2400 m; (May-) June-November (-February).

Isocoma hartwegii has been treated as only varietally distinct from *I. veneta* by McVaugh (1984). Although it is likely that the two probably are related as sister taxa, they may reasonably be considered as separate species, consistent in treatment (in the present study) with other closely related taxa in the genus. *Isocoma hartwegii* has shorter, pinnatifid (vs. merely toothed) leaves and longer corolla lobes than *I. veneta*. The two taxa are parapatric (Map 4), and in east central Zacatecas and southwestern San Luis Potosí, where both occur, plants that might be regarded as intermediate are rare among the numerous specimens representing the two extremely well collected species. The single collection known from Hidalgo (Tula, *Viereck 1279*-US) is typical in morphology. A collection of *I. veneta* from the same area, however (Tula, *Pringle 6405*-US 2 sheets), comprises branches typical of the latter as well as one branch apparently intermediate between *I. veneta* and *I. hartwegii*. Both branches on *Pringle 6405* from ND-G are intermediate, and two branches on a MO sheet are typical *I. veneta*.

Within his concept of *Isocoma hartwegii*, Hall (1928) included *I. coronopifolia* as well as *I. tenuisecta*. The latter has pinnatifid leaves and consistently hispidulous vestiture like *I. hartwegii*, but it has smaller heads with fewer flowers, phyllaries with scarious margins and thicker apices, longer achenes, and it is distantly separated in geography.

9. *Isocoma humilis* Nesom.

Isocoma humilis Nesom, *sp. nov.* TYPE: UNITED STATES. Utah: Washington Co., Zion National Park, sandstone, 25 Sep 1971, *W.R. Leverich 1045A* (HOLOTYPE: TEX!).

Isocomae rusbyo E. Greene similis capitulis latis multifloribus et phyllariis ovatis marginibus scariosis apicibusque tantum punctatiglandulosis sed habitu humili acervato, foliis integris, vestimento villoso, et acheniis minoribus costis vadosioribus minus resinosis differt.

Shrubs apparently with a low, moundlike habit, with short, densely and highly branched stems mostly 4-8 cm high; young stems and leaves moderately villous with short, crisped, white hairs. Leaves gland dotted but not resinous, narrowly oblanceolate, 5-10 (-18) mm long, 1.5-3.0 (-5.0) mm wide, sometimes entire but usually with 1-2 (-3) pairs of pinnately arranged teeth or shallow lobes, the teeth and leaf apices with a thick, short, white, spinulose claw. Heads 19-28 flowered, solitary or in pairs, on bracteate pedicels 3-10 mm long, the involucre campanulate, basally rounded, 6-7 mm wide, 5-6 mm high; phyllaries narrowly ovate, in 3-4 strongly graduated series, white indurated with narrow but prominently scarious margins, with a sharply delimited, gland dotted apical portion, without resin pockets. Corollas 4.0-5.0 mm long, the tube 2.3-2.8 mm long, the lobes triangular, 0.5-0.8 mm long. Achenes 1.5-2.0 mm long, obovate, sericeous, with 6-8 slightly raised ribs; longest pappus bristles 3-4 mm long. Chromosome number unknown.

Additional collections examined: UNITED STATES. Utah: Washington Co., Dixie State Park, Snow Canyon, near St. George, red sandstone canyon, siliceous sandy soil, 25 Sep 1971, *Leverich 1042A* (TEX); Washington Co., 15 mi W of Zion National Park on Utah 15, sandstone, sand, 25 Sep 1971, *Leverich 1044A* (TEX).

Isocoma humilis Nesom is recognized by its low stature and rounded habit, villous vestiture, small, toothed leaves, and small corollas and achenes. It occupies a geographic position between that of *I. rusbyi* and *I. acradenia* (Map 2), but its relationships are difficult to perceive. It is similar to *I. acradenia* var. *eremophila* in its toothed leaves and its indurated phyllaries with sharply delimited apical portions but more similar to *I. rusbyi* in its broad, many

flowered heads and ovate phyllaries with scarious margins and merely punctate glandular apical portions. It differs from both species in its habit, vestiture, small leaves, and small achenes, although *I. acradenia* produces achenes that rarely range as small.

All three collections of *Isocoma humilis* were made by William Leverich, at the time a graduate student in botany at the University of Texas who had begun an investigation of the systematics of *Isocoma*. He did not complete his studies but his eye for plants of the genus produced interesting collections and observations. The occurrence of *Isocoma* in Washington Co. was not recorded by Welsh (1983).

10. *Isocoma menziesii* (Hook. & Arn.) Nesom.

Isocoma menziesii (Hook. & Arn.) Nesom. BASIONYM: *Pyrrocoma menziesii* Hook. & Arn., *Bot. Beechey Voy.* 351. 1838.

Variable in habit, vestiture, and leaf morphology. Heads turbinate, basally obtuse to acute, with (15-) 18-25 (-28) flowers, the involucres (6-) 7-9 mm high, 6-8 mm wide; phyllaries oblong oblanceolate to oblong lanceolate, usually the lower 2/3 strongly white indurated, lanceolate acute to rounded at the apex, mostly with green punctate apical areas, small resin pockets sometimes developed in var. *menziesii* and var. *decumbens* (E. Greene) Nesom; receptacles with long, narrowly to broadly lanceolate alveoli. Corollas 5.0-6.5 (-7.0 in var. *diabolica* Nesom) mm long, the tube 3-4 mm long, the lobes 0.5-0.8 mm long, deltate, 1/5-1/3 the length of the limb. Achenes 2.3-3.6 (-4.0) (-5.0 in var. *diabolica*) mm long, with 5-6 orange resinous ribs, or sometimes with up to 10-11 thinner, apparently nonresinous nerves, sericeous, teretish to somewhat flattened.

Isocoma menziesii comprises a series of morphologically disparate but intergrading taxa, which have been treated as varieties or subspecies of *I. veneta* in many previous studies. The chief dissenter was the chief architect of the genus, E.L. Greene himself, who regarded each of these as a separate species. Indeed, each variety is as singular in its typical morphology as other taxa of *Isocoma* recognized as distinct species in the present treatment. Numerous intergrades (as noted below), however, have deterred most students of the group, including the present author, from maintaining more than one species, but field studies and more detailed analyses of morphology may yet show some of these taxa to be isolated to a greater degree than hitherto suspected. One such taxon, *I. arguta*, is segregated as a distinct species in the present treatment.

All of the taxa included here in *Isocoma menziesii*, however, are distinct from typical *I. veneta* and none of them intergrade with it. Compared to the plants of central México, all those of the Pacific coast (*I. menziesii*) differ in their vestiture, longer involucres, and their longer achenes. As in many of the

species of *Isocoma*, these two have parallel tendencies of variation, but they are no more alike than other presumably closely related but distinct species. Further, *I. veneta* and *I. menziesii* are strongly different in habitat and disjunct more than 1100 kilometers at point of closest approach to each other.

Key to the varieties of *I. menziesii*

1. Leaves obovate, coarsely serrate, fleshy thick; stems and leaves glabrous; plants decumbent. ..... var. *sedoides*

1′ Leaves obovate to oblanceolate, entire to toothed, not fleshy thick, or if so then at least the stems prominently villous; stems and leaves glabrous to villous, tomentose, or glandular; plants erect to decumbent. .....(2)

2. Herbage stipitate glandular, essentially without other vestiture. (3)

2′ Herbage glabrous to villous or tomentose, not prominently glandular. .....(4)

3. Plants strictly erect; leaves 4-10 mm wide; capitulescence distinctly corymboid; achenes mostly 4-5 mm long; San Benito and Santa Clara cos. ..... var. *diabolica*

3′ Plants decumbent to erect; leaves 2-4 mm wide; capitulescence corymboid to loosely paniculate; achenes mostly 2.3-3.6 mm long; San Diego Co. to Baja California Norte. ..... var. *decumbens*

4. Plants glabrous or slightly hairy, sometimes resinous. .....(5)

4′ Plants prominently tomentose or villous. .....(8)

5. At least the lower leaves with serrate margins. .....(6)

5′ Leaves entire or few toothed at the apex. .....(7)

6. Corollas 6-7 mm long; achenes (3.8-) 4.5-5.0 mm long. ..... var. *diabolica*

6′ Corollas 5-7 mm long; achenes 2.3-3.6 mm long. . var. *vernonioides*

7. Leaves distinctly spreading toothed or lobed at the apex; phyllary apices usually spreading to slightly reflexed. ..... var. *tridentata*

7′ Leaves entire to shallowly serrate at the apex; phyllary apices erect, rarely spreading. ..... var. *menziesii*

8. Herbage villous with spreading-crisped, relatively thick based hairs; leaves oblanceolate to oblong oblanceolate, commonly toothed along most of the margins; stems usually erect. .....var. *vernonioides*

8′ Herbage finely and closely gray tomentose; leaves narrowly oblanceolate, entire to few toothed; stems decumbent to erect. . ..... var. *decumbens*

a. Var. decumbens (E. Greene) Nesom.

Isocoma menziesii (Hook. & Arn.) Nesom var. decumbens (E. Greene) Nesom, *comb. nov.* BASIONYM: *Isocoma decumbens* E. Greene, Leafl. Bot. Observ. Crit. 1:172. 1906. LECTOTYPE (designated here): UNITED STATES. California: San Diego Co., clay depression on mesas, near San Diego, 13 Sep 1903, *T.S. Brandegee 3405* (ND-G!; Isolectotypes: GH!, LL!, NY!, US!). *Haplopappus venetus* (Kunth) S.F. Blake var. *decumbens* (E. Greene) Munz, *Man. S. Calif. Bot.* 522. 1935. The combination *Isocoma veneta* (Kunth) E. Greene var. *decumbens* (E. Greene) Jepson (*Man. Fl. Pl. S. Calif.* 1029. 1925) was not legitimately made, as it was based on an apparently unpublished name, "*Bigelowia veneta* var. *decumbens* Bdg." The lectotype has a handwritten label as "*Isocoma decumbens* Greene;" the duplicates have a printed label distributed by C.F. Baker as "*Isocoma decumbens* (Brand.) Greene."

Bigelowia furfuracea E. Greene, Bull. Calif. Acad. Sci. 1:87. 1885. TYPE: Probably MÉXICO. Baja California Norte (according to Greene): collection data not specified (UC, see Hall 1928 for comments). *Haplopappus venetus* (Kunth) S.F. Blake subsp. *furfuraceus* (E. Greene) Hall, Carnegie Inst. Washington Publ. 389:226. 1928. *Haplopappus venetus* (Kunth) S.F. Blake var. *furfuraceus* (E. Greene) Munz, *Man. S. Calif. Bot.* 523. 1935. *Isocoma veneta* (Kunth) E. Greene var. *furfuracea* (E. Greene) Beauchamp, Phytologia 59:437. 1986.

Nearly prostrate to decumbent or somewhat erect shrubs, closely arachnoid and minutely glandular, sometimes one or the other. Leaves narrowly oblanceolate, mostly entire or with 1-2 pairs of teeth near the apex, 5-22 mm long, 2-4 mm wide, commonly densely arranged, often in axillary fascicles. Heads turbinate-campanulate, usually arranged in a loose capitulescence with numerous (1-) few headed clusters at the ends of slender, often lax branches; phyllaries narrowly oblanceolate-oblong, strongly white indurated, usually with an orange midvein from top to bottom, acute to rounded at the apex, the middle and inner sometimes short aristate, with a sharply delimited, villosulous apical area, punctate or often with several small but distinct resin pockets. Chromosome number, $n = 12$ pairs (Raven, *et al.* 1960, as *Haplopappus venetus* var. *vernonioides*).

Localized in southern San Diego Co., San Clemente and Santa Catalina Islands, and immediately adjacent Baja California Norte; sandy flats or slopes, commonly in disturbed sites, 10-50 (-175) m; July-November.

Plants of var. *decumbens* may be erect to decumbent in habit, commonly with slender stems and small, sometimes crowded leaves, but they are particularly distinguished by their vestiture. The stems, leaves, and phyllaries most commonly produce a close, arachnoid tomentum of hairs finer than those in var. *vernonioides*, and beneath this, a layer of minute, stipitate glands. Tomentose plants are the more common, but the development of both the tomentum and the glands is variable and some plants may produce only one or the other. The type of *Bigelovia furfuracea* E. Greene apparently produces only minute glands (Hall 1928), lacking other types of trichomes. The narrow, strongly indurated phyllaries, sometimes with resin pockets (also found in vars. *menziesii* and *tridentata* [E. Greene] Nesom), are similar to those of *I. acradenia*, and the possibility of genetic influx from the latter should be investigated further.

The boundaries between var. *decumbens* and both var. *menziesii* and var. *vernonioides* are blurred by intermediates, although there does appear to be some degree of isolation. Collections of var. *decumbens* and var. *menziesii*, including apparent intermediates, have been in San Diego Co. at Lindo Lake (*Youngberg 29* and *29a*-LL) and at Chula Vista (various collectors). Many of these prominently tomentose plants appear to be otherwise identical in morphology to var. *menziesii*. In most cases, I have arbitrarily identified plants as var. *menziesii* if they are completely glabrous, even though they are otherwise similar to var. *decumbens*.

b. Var. *diabolica* Nesom.

Isocoma menziesii (Hook. & Arn.) Nesom var. **diabolica** Nesom, *var. nov.* TYPE: UNITED STATES. California: San Benito Co., Diablo Range, 9 mi SE of turnoff to Pinnacles Natl. Monument along Calif. Rte. 25, openly wooded slope with *Quercus turbinella*, *Juniperus californica*, and assorted shrubs, 1250 ft, locally abundant, many branched shrub, 5 Oct 1985, *D.J. Keil 19042* (HOLOTYPE: TEX!; Isotypes: OBI, UCR!).

Isocomae menziesii (Hook. & Arn.) Nesom var. *vernonioidi* (Nutt.) Nesom similis sed vestimento dense stipitati-glanduloso plerumque sine villis, corollis ac acheniis longioribus, et habitionibus montanis differt.

Erect shrubs 4-6 dm tall, with distinctly whitish stems, the stems, leaves, and phyllaries densely viscid with stipitate glandular hairs, sometimes eglandular but then densely resinous viscid, without other pubescence except sometimes very sparsely villous in the leaf axils or along stems. Leaves obovate to narrowly oblanceolate or narrowly elliptic-oblanceolate, the largest lower 2-4 cm long, 5-10 mm wide, with the margins shallowly serrate, the upper sharply reduced in size, entire. Heads 20-26 flowered, in corymboid capitulescences, turbinate, the involucres 7-9 mm high; phyllaries with an apical area 1/2-1/3

the total length, gradually developed from the base, punctate, the tip slightly reflexed or crisped, often short-spinulose. Corollas 6.0-7.0 mm long. Achenes (3.8-) 4.3-5.0 mm long, narrowly oblong-oblanceolate, somewhat compressed, densely sericeous.

San Benito and Santa Clara cos., apparently most abundant in the Diablo Range of the former; open slopes and cliffs, mostly in foothill woodlands, 15-400 m; August-October.

Additional collections examined: UNITED STATES. California: San Benito Co., Tres Pinos–Paicines, 22 Sep 1920, *Abrams 7661* (NY); San Benito Co., near Emmett's Station, Panoche Pass Road, exposed cliffs, 25 Sep 1927, *Ferris 6889* (LL); San Benito Co., along Rte. 25 SE of Hollister, 2.5 mi NW of Paicines, foothill woodland area, 600 ft, 4 Sep 1983, *Keil 17924* (UCR). Santa Clara Co., Calaveras Road 2 mi E of Milpitas, 50 ft, open hills, 10 Oct 1955, *Rose 55183* (TEX).

These plants were included by Hall (1928) for the most part within his concept of *Isocoma veneta* var. *vernonioides*, but they are distinctive in morphology as well as geography. They are the only ones of *I. menziesii* to inhabit primarily inland, montane sites. Var. *diabolica* differs from var. *vernonioides* in its resinous, usually densely stipitate glandular vestiture (with villous hairs lacking or sparsely present along the stems), and in its consistently reduced, somewhat bractlike upper cauline leaves, longer corollas, and longer achenes. In vestiture and leaf morphology, as well as the inland habitats, these plants are reminiscent of *I. acradenia* var. *bracteosa*, which occurs only slightly to the south and east, but the phyllaries of var. *diabolica* lack well developed resin pockets. Although the plants of var. *diabolica* are consistent in morphology, some of var. *vernonioides*, including the type of *I. villosa* E. Greene, also are stipitate glandular. Further, some plants from San Diego Co. (e.g., *Brandegee 1633*-NY, US-2 sheets), as well as a number of collections from around King City in Monterrey County (e.g., *Rose 36735*-GH, US), may be very similar to var. *diabolica* in habit and vestiture, although in achene and corolla size they are more typical of other varieties of *I. menziesii* (identified here as var. *decumbens* and var. *vernonioides*, respectively).

Populations of *Isocoma acradenia* var. *bracteosa* occur in close proximity to those of var. *diabolica* (e.g., San Benito Co., Griswold Hills, ca. 3 mi S of jct of Idria road with Panoche Pass road, *Ferris & Ernst 13083*-NY).

c. Var. *menziesii*

Isocoma menziesii (Hook. & Arn.) Nesom var. *menziesii* BASIONYM: *Pyrrocoma menziesii* Hook. & Arn., *Bot. Beechey Voy.* 351. 1838. TYPE: UNITED STATES. California: [near San Diego?], 1786-89, *A. Menzies* (K, GH-photo!, US-photo!). (*H*)*Aplopappus menziesii* (Hook. & Arn.) Torr. & A. Gray, *Fl. N. Amer.* 2:242. 1842. *Bigelovia menziesii* (Hook.

& Arn.) A. Gray, Proc. Amer. Acad. Arts 8:638. 1873. See comments by Hall (1928) regarding the type specimens of this taxon and *I. vernonioides*.

Isocoma oxyphylla E. Greene, Leafl. Bot. Observ. Crit. 1:171. 1906. LECTOTYPE (designated here): UNITED STATES. California: San Diego Co., Jamul Valley, near San Diego, 1875, *E. Palmer 134* (US!; Isolectotypes: BM, UC). *Haplopappus venetus* (Kunth) S.F. Blake subsp. *oxyphyllus* (E. Greene) Hall, Carnegie Inst. Washington Publ. 389:225. 1928. *Haplopappus venetus* (Kunth) S.F. Blake var. *oxyphyllus* (E. Greene) Munz, *Man. S. Calif. Bot.* 523. 1935. *Isocoma veneta* (Kunth) E. Greene var. *oxyphylla* (E. Greene) Beauchamp, Phytologia 59:438. 1986.

Haplopappus fasciculatus Vasey & Rose, Proc. U.S. Natl. Mus. 11:530. 1888. TYPE: MÉXICO. Baja California Norte: San Quentín Bay, Jan 1889, *E. Palmer 635* (HOLOTYPE: US!).

Shrubs 0.5-2.5 m tall, glabrous and usually resinous, erect or in spreading clumps, rarely decumbent. Leaves narrowly oblanceolate, 15-30 (-40) mm long, 3-8 mm wide, entire or with 1-2 pairs of apical teeth or shallow lobes, axillary fascicles commonly produced. Phyllaries sometimes reflexed or spreading at the apex, especially in San Diego Co., commonly with a thin, orange midvein extending from base to tip, small resin pockets sometimes present. Chromosome number, $n = 12$ pairs (Pinkava & Keil 1977, as *H. venetus* [Kunth] S.F. Blake subsp. *furfuraceus* [E. Greene] Hall).

Baja California Norte and Baja California Sur, Orange and San Diego cos., San Clemente and Santa Catalina Islands, largely replaced northward by var. *vernonioides*, except for apparently disjunct populations in the vicinity of San Francisco (see below); chaparral, scrub communities, dunes or sandy flats, sandy arroyos, stream banks, edges of saline ponds, rocky canyon walls; 2-350 (-1100) m; (April-) August-January.

Plants of var. *menziesii* are similar to those of var. *decumbens* but different in their glabrous herbage, larger leaves, and heads commonly in more compact and distinctly corymboid capitulescences.

The type of *Isocoma menziesii*, with its glabrate herbage and narrowly lanceolate leaves with a few shallow teeth near the apex, is more similar to plants previously known as *I. oxyphylla* E. Greene than any other taxon. In fact, similar plants occur through nearly the whole range of var. "*oxyphylla*." To the north of San Diego and Orange counties, plants (var. *vernonioides*) have a tendency to produce a villous vestiture and obovate leaves evenly toothed along most of the margin. The two taxa, however, appear to be completely intergrading, and many plants are necessarily identified arbitrarily. In San Diego County, nearly all the plants identified here as var. *menziesii* are morpholog-

ically influenced to some degree either by var. *decumbens* or by var. *vernonioides*. In the present study, I have identified glabrous or glabrate plants with leaves prominently toothed along the margins as well as plants prominently villous but with more weakly toothed leaves as var. *vernonioides*. Glabrous or glabrate plants with entire to apically few toothed leaves are var. *menziesii*. Clearly, these two taxa are essentially the same biologically as those perceived by Hall, but I have associated the type of *I. menziesii* with his "subsp. *oxyphylla*" rather than *I. vernonioides*.

From Encinitas to La Jolla (San Diego Co.), a number of collections have been made of decumbent plants otherwise mostly similar to erect plants of var. *menziesii*. In Baja California N and S, spreading to somewhat decumbent plants are relatively common, and the significant variability in leaf shape in that area needs to be investigated further. *Haplopappus fasciculatus* is a form with densely arranged leaves but otherwise within the geographical and morphological range of var. *menziesii*, which commonly produces axillary fascicles of small leaves.

The plants identified as var. *menziesii* from the vicinity of San Francisco (e.g., *Brandegee s.n.*-NMC, NY; *Cannon s.n.*-GH) produce sparsely villous stems but nearly glabrous leaves with a few, shallow teeth only on the distal margins, and they are nearly identical to many collected from around San Diego. The San Francisco populations are far disjunct from others of var. *menziesii* and they appear to be separated from those of var. *vernonioides* as well; at least I have seen no collections of the latter from Santa Cruz Co., and those from Monterrey Co. are strongly divergent in morphology.

d. Var. *sedoides* (E. Greene) Nesom.

Isocoma menziesii (Hook. & Arn.) Nesom var. **sedoides** (E. Greene) Nesom, *comb. nov.* BASIONYM: *Bigelowia veneta* var. *sedoides* E. Greene, Bull. Calif. Acad. Sci. 2:400. 1887. TYPE: UNITED STATES. California: [Santa Barbara Co.], Santa Cruz Island, "edges of low cliffs overhanging the sea, on the north side of the island," other data not specified (CAS). *Isocoma sedoides* (E. Greene) E. Greene, Leafl. Bot. Observ. Crit. 1:172. 1906. *Isocoma veneta* (Kunth) E. Greene var. *sedoides* (E. Greene) Jepson, *Man. Fl. Pl. Calif.* 1029. 1925. *Haplopappus venetus* (Kunth) S.F. Blake var. *sedoides* (E. Greene) Munz, *Man. S. Calif. Bot.* 522. 1935. See comments following the citation of *I. latifolia*.

Plants glabrous or nearly so; stems stout, decumbent, prostrate, or pendent. Leaves clearly succulent, broadly obovate to oblanceolate, coarsely serrate. Heads in a dense, capitate cluster.

California (Santa Rosa, Santa Cruz, San Miguel, Anacapa, and Santa Catalina Islands, and adjacent coast from the vicinity of Newport Beach north

to Morro and Cambria), northwestern Baja California Norte; dunes, coastal scrub, talus slopes, commonly pendulous on cliff edges, 0-20 m; (April-) June-December.

Var. *sedoides* (E. Greene) Nesom appears to be somewhat distinct in habitat though sympatric in distribution with var. *vernonioides*, and intermediates between the two have been collected at every locality where var. *sedoides* occurs. Some identifications have to be made arbitrarily. The label of a collection from Piedras Blancas Point in San Luis Obispo Co. (*Leverich 1072*-TEX) notes that a mixed population occurred there: upright plants (var. *vernonioides*), with glabrous to pubescent herbage, and a "low form in tangled woody clumps up to 6 ft in diameter," with succulent leaves (var. *sedoides*). Plants of the single collection from México here identified as var. *sedoides* (Baja California Norte, ca. 1 mi N of mouth of Arroyo Santo Tomás on coastal bluffs, *Wiggins & Thomas 406*-US) were noted as being "shrubby."

e. Var. *tridentata* (E. Greene) Nesom.

Isocoma menziesii (Hook. & Arn.) Nesom var. **tridentata** (E. Greene) Nesom, *comb. nov.* BASIONYM: *Bigelovia tridentata* E. Greene, Bull. Torrey Bot. Club 10:126. 1883. TYPE: MÉXICO. Baja California Norte: Cedros Island, 1885, *E. Greene s.n.* (HOLOTYPE: UC). *Isocoma tridentata* (E. Greene) E. Greene, Erythea 2:111. 1894. (*H*)*Aplopappus tridentatus* (E. Greene) S.F. Blake, Contr. U.S. Natl. Herb. 23:1493. 1926. *Haplopappus venetus* (Kunth) S.F. Blake subsp. *tridentatus* (E. Greene) Hall, Carnegie Inst. Washington Publ. 389:225. 1928.

Linosyris dentata Kellogg, Proc. Calif. Acad. Sci. 2:16. 1863. TYPE: MÉXICO. Baja California Norte: Cedros Island, *Veatch* (UC-see comments by Hall 1928).

Distinguished by its narrowly oblanceolate leaves 15-30 mm long, 2-5 mm wide, consistently with 1-2 (-3) pairs of prominently divergent teeth or lobes near the apex and its phyllaries with triangular-lanceolate-attenuate, reflexing or spreading apices. Erect shrubs 0.8-1.5 m tall, completely glabrous, usually glutinous; phyllaries often with small resin pockets; achenes 2.3-2.6 mm long.

Cedros Island of Baja California Norte and immediately adjacent coastal mainland, from near Punta Prieta (Baja California Norte) to the Vizcaino region (Baja California Sur); coast or upper strand, dunes, arroyos, pond edges, rocky areas, 1-125 (-200) m; October-May.

Var. *tridentata* is similar to var. *menziesii* and apparently intergrades with it on the mainland, particularly in the region of Punta Prieta, but numerous and relatively uniform collections of these distinctive plants have been made within the small area of its range, both on Cedros Island and the mainland. The spreading-reflexing phyllary apices are distinctive although similar ones

sometimes occur in plants of var. *menziesii*, particularly those from San Diego County and vicinity.

f. Var. *vernonioides* (Nutt.) Nesom.

Isocoma menziesii (Hook. & Arn.) Nesom var. **vernonioides** (Nutt.) Nesom, *comb. nov.* BASIONYM: *Isocoma vernonioides* Nutt., Trans. Amer. Phil. Soc., ser. 2, 7:320. 1840. HOLOTYPE: UNITED STATES. California: Santa Barbara, in marshes near the sea, Apr-May [1836], *T. Nuttall s.n.* (BM, GH-photo!; Probable isotypes: GH!, NY!). *Isocoma veneta* (Kunth) E. Greene var. *vernonioides* (Nutt.) Jepson, *Fl. W. Mid. Calif.* 560. 1901. *Haplopappus venetus* (Kunth) S.F. Blake subsp. *vernonioides* (Nutt.) Hall, Carnegie Inst. Washington Publ. 389:224. 1928. The branch on the NY sheet closely matches the BM plant and description; that on the GH sheet is significantly different. Hall (1928) also cited a duplicate at K.

Isocoma leucanthemifolia E. Greene, Leafl. Bot. Observ. Crit. 1:171. 1906. LECTOTYPE (designated here): UNITED STATES. California: San Diego Co., Warner's Ranch, 21 Oct 1889, *C.R. Orcutt* (US!).

Isocoma microdonta E. Greene, Leafl. Bot. Observ. Crit. 1:171. 1906. LECTOTYPE (designated here): UNITED STATES. California: [Santa Barbara Co.], Santa Maria, Nov 1893, *Mrs. Blochman s.n.* (ND-G!).

Isocoma latifolia E. Greene, Leafl. Bot. Observ. Crit. 1:172. 1906. LECTOTYPE (designated here): UNITED STATES. California: [Santa Barbara Co.], Santa Cruz Island, Jul-Aug 1886, *E.L. Greene s.n.* (ND-G!; Isolectotype: GH!). On the ND-G sheet (marked by Greene as "*Isocoma latifolia*, Greene Type!") are four branches, two of which are prominently villous, matching Greene's description of this taxon. The other two branches are nearly glabrous and are referable to var. *sedoides* in the present study. The GH specimen is var. *sedoides*. The glabrous branches in this collection may ultimately be found to represent elements of the type of Greene's *Isocoma sedoides*.

Isocoma villosa E. Greene, Leafl. Bot. Observ. Crit. 1:172. 1906. LECTOTYPE (designated here): UNITED STATES. According to Greene, "sent from southern California" and "grown in the University Botanic Garden" at Berkeley, where gathered in Nov 1893 by Mr. Davy (ND-G!; Isolectotype: ND-G!). The label data on the two type sheets correspond exactly with Greene's published data. Three branches are preserved and probably are from the same plant;

the stems are villous-pilose and the leaves are densely stipitate glandular and sparsely pilose.

Erect or ascending to somewhat decumbent subshrubs 0.5-1.0 m tall, glabrate to hirtellous- or villous-pilose or densely gray tomentose with long, vitreous, flattened hairs, sometimes stipitate glandular as well. Leaves glabrate to villous, linear to oblanceolate or spatulate-oblong, 1-4 cm long, 2-6 (-9) mm wide, pinnately toothed or shallowly lobed. Phyllaries acute attenuate to deltate or nearly oblong with a blunt apex, not aristate or rarely only slightly so, usually glabrous. Achenes lightly sericeous, usually with 5-6 orange-resinous nerves but sometimes with 10-11 thin, light colored nerves. Chromosome number, $n = 12$ pairs (Raven, *et al.* 1960; De Jong & Montgomery 1963; Pinkava & Keil 1977; Keil 1979; Semple, *et al.* 1989, as *I. veneta*).

Northern Baja California Norte, abundant in California primarily along the coast from San Diego north to Santa Barbara and on all the Channel Islands, more infrequent northward; coastal bluffs and dunes, sandy flats, borders of salt marshes, and occasionally on dry slopes, 5-400 m in California, 650-900 m in México; (April-) July-December.

In the southern area of their range (particularly San Diego and Riverside Cos.), plants of var. *vernonioides* produce small leaves that are often nearly glabrous, perhaps reflecting the influence of genes from var. *menziesii*. Among putative intermediates with var. *menziesii*, plants with regularly serrate leaf margins have been arbitrarily identified here as var. *vernonioides*.

Several similar but atypical collections from the area of Pasadena (e.g., *Grinnell s.n.*-NY, US; *McClatchie s.n.*-NY) are apparently decumbent with loose, long pedicellate capitulescences and have phyllaries with large, sharply delimited apical areas.

See var. *sedoides* for other comments on variation in var. *vernonioides*; further detailed comments regarding variation in the latter were provided by Hall (1928).

pluriflora !

11. *Isocoma plurifolia* (Torr. & A. Gray) E. Greene

Isocoma plurifolia (Torr. & A. Gray) E. Greene, Erythea 2:111. 1894. BASIONYM: *Linosyris plurifolia* Torr. & A. Gray, *Fl. N. Amer.* 2:233. 1842. TYPE: UNITED STATES. ["Sources of the Canadian"], from the Long Expedition, 1820, *Dr. E. James* (HOLOTYPE: NY!, see comments below regarding the collection locality and type). *Bigelovia plurifolia* (Torr. & A. Gray) A. Gray, Proc. Amer. Acad. Arts 8:638. 1873. *Haplopappus plurifolius* (Torr. & A. Gray) Hall, Carnegie Inst. Washington Publ. 389:237. 1928.

Linosyris wrightii A. Gray, *Pl. Wright.* 1:95. 1852. TYPE: UNITED STATES. Texas: [El Paso Co.], valley of the Rio Grande, 60 or 70 mi below El Paso, Sep 1852, *C. Wright 284* (HOLOTYPE: GH!, NY-photo!; Isotypes: GH!, US!). *Bigelovia wrightii* (A. Gray) A. Gray, Proc. Amer. Acad. Arts 8:639. 1873. *Isocoma wrightii* (A. Gray) Rydb., Bull. Torrey Bot. Club 33:152. 1906.

Linosyris heterophylla A. Gray, *Pl. Wright.* 1:95. 1852. TYPE: UNITED STATES. Texas: [Reeves Co.?], valley of the Pecos, Aug 1849, *C. Wright 283* (HOLOTYPE: GH!; Isotype: ND-G!). *Aster heterophyllus* (A. Gray) O. Ktze., *Rev. Gen.* 318. 1891. *Isocoma heterophylla* (A. Gray) E. Greene, Erythea 2:111. 1894. (*H*)*Aplopappus heterophyllus* (A. Gray) S.F. Blake *in* Tidestrom, Contr. U.S. Natl. Herb. 25:546. 1925.

Linosyris hirtella A. Gray, *Pl. Wright.* 1:95. 1852. TYPE: UNITED STATES. Texas: [Jeff Davis Co.], "valley of the Limpia," Aug 1849, *C. Wright 285* (HOLOTYPE: GH!; Isotype: GH!). *Bigelovia wrightii* (A. Gray) A. Gray var. *hirtella* (A. Gray) A. Gray, *Synopt. Fl. N. Amer.* 1(2):142. 1884. *Isocoma hirtella* (A. Gray) Heller, Muhlenbergia 1:6. 1900.

Isocoma oxylepis Woot. & Standl., Contr. U.S. Natl. Herb. 16:180. 1913. TYPE: MÉXICO. Chihuahua: Mexican boundary line near White Water, 11 Sep 1893, *E.A. Mearns 2288* (HOLOTYPE: US!).

Isocoma halophytica B. Turner, Sida 5:23. 1972. TYPE: MÉXICO. Chihuahua: S end of Laguna Jaco, 9 Sep 1940, *I.M. Johnston & C.H. Muller 1090* (HOLOTYPE: MICH; Isotypes: GH!, TEX!).

Shrubs 0.5-1.0 (-1.5) m tall, with whitish stems. Leaves spreading-ascending, often curving upwards, oblanceolate to narrowly oblong oblanceolate or nearly linear, mostly 1-4 (-5) cm long, 3.0-5.0 (-9.0) mm wide, the margins entire or uncommonly with 1 (-3) pairs of shallow teeth or lobes, often sparsely and minutely ciliate along the margins, rarely more densely hirtellous, gray green, usually not glutinous, the blade with imbedded glandular papillae or less commonly short stipitate glandular, otherwise glabrous to sparsely hispidulous. Heads in dense, corymboid capitulescences, (8-) 11-17 (-21) flowered, campanulate to broadly turbinate, the involucres 3.2-5.5 mm high, 2.5-4.0 mm wide; phyllary apex barely differentiated, or if green and thicker, then surrounded by a scarious-translucent margin, not glutinous; receptacles with narrowly triangular to deltate alveoli. Corollas 5-6 mm long, the tube 3.0-4.0 mm, glabrous, the lobes 1.0-1.8 mm long, 2/5-3/5 the length of the limb. Achenes 1.5-1.9 (-2.8) mm long, with 6-8 thick, resinous ribs. Chromosome number: $n = 6$ pairs (Powell & Turner 1963, as *I. heterophylla*, Reeves Co.; Weedin & Powell 1978, as *H. wrightii*, Culberson Co., Tex.; Powell & Powell

1977, as *H. wrightii*, Culberson and Reeves cos., Tex.); $n = 12$ pairs (Jackson 1959, as *H. plurifolia*, Rio Arriba Co., N.M.; Turner, Powell, & Watson 1973, as *I. wrightii*, Brewster Co., Tex.; Powell & Powell 1977, as *H. wrightii*, Hudspeth Co., Tex.).

Chihuahua, Coahuila, Texas, New Mexico, Arizona; igneous or calcareous substrate, less commonly over gypsum, dunes, sandy or clay loam, commonly with *Larrea-Prosopis*; 400-1400 (-1600) m; (April-) July-October.

The type specimen was first identified by Torrey as *Chrysocoma graveolens* Nutt. (Ann. Lyceum Nat. Hist. New York 2:211. 1828.), from a series of collections sent to him by the naturalist Dr. E.P. James of the Long Expedition. The authorship of this name was later incorrectly attributed to Torrey himself, but in 1842, Torrey & Gray recognized that the plant was not the same species as Nuttall's (a species of *Chrysothamnus*) and named it as a member of *Linosyris*. Torrey & Gray, as well as Gray in later publications, placed *Chrysocoma graveolens* (sensu Torrey) as a synonym of *Linosyris plurifolia* Torr. & A. Gray.

The type collection of *Linosyris plurifolia* evidently was made at the northern edge of the range of the species; the label gives no specific information but Torrey & Gray noted that it might have come from the "Upper Missouri or Platte?." Part of Long's expedition, including Long & James, left Colorado in late July and August of 1820 and traveled southeastward into what they believed to be "sources of the Canadian" River. Osterhout (1920), however, thought it more likely that these were actually tributaries of the Cimarron in southeastern Colorado and adjacent New Mexico. In any case, the expedition continued to travel eastward and the type probably was collected either in the Texas panhandle or the northeastern corner of New Mexico at the upper extremity of the range of the species. No records outside the Texas panhandle are shown in the *Atlas of the Flora of the Great Plains* (GPFA 1977), but it is recorded here for northeastern New Mexico in Harding Co. (*A.H. Wright s.n.*-NMC), and it has been reported for Union Co., New Mexico (Martin & Hutchins 1981, as *Haplopappus heterophyllus*; added on Map 2).

Isocoma plurifolia is recognized by its relatively small, few flowered heads, deeply cut corolla lobes, and usually entire, mostly glabrous, nonglutinous but papillate or stipitate glandular leaves commonly with sparsely ciliate margins. The species is variable in vestiture but its geographic boundaries appear to be well defined and there is no reasonable way to formally recognize the variants. See further comments below and following the description of *I. tomentosa*.

Plants of *Isocoma plurifolia* with shallowly toothed or lobed leaves are relatively common in central New Mexico along the western margin of the range of the species, where it approaches *I. azteca*. In Sandoval Co., New Mexico, *Arsene 16486* (LL) from the vicinity of San Ysidro is typical *I. plurifolia*, but *Hartman 3387* (LL) from 21 mi NW of Bernalillo bears three separate branches, all small headed like *I. plurifolia* and producing deeply in-

cised corolla lobes, but the lower leaves on two of the branches are shallow pinnately toothed. Similar plants have been collected from another locality in Sandoval Co. (Puerco River, *Losure 197*-ARIZ 2 sheets), in Rio Arriba Co. (Chamita, *Eggleston 20470*-GH, NY-2 sheets), Santa Fe Co. (*e.g.*, 13 mi SW of Santa Fe, *Plowman & Kilham AP139*-GH), and Socorro Co. (near Ft. Craig, *Rusby 2286*-ND-G). It is possible that these plants show the genetic influence of *I. azteca*, but other plants with few toothed or shallowly lobed leaves, including the type of *Linosyris wrightii* A. Gray, occur sporadically throughout the range of *I. plurifolia*, in most cases apparently significantly removed from possible sources of genetic influence from any other species. The prominently lobed leaf plants are mostly along the western margin of the species and might ultimately be recognized as a weakly defined variety.

Isocoma plurifolia was reported by Kearney & Peebles (1951, as *Haplopappus heterophyllus*) as widespread in Arizona; some of the Arizona plants previously identified as this species are *I. rusbyi*, which differs in its larger heads with more flowers and longer achenes with much thicker, apically extended ribs, and some apparently are forms of *I. acradenia* with only weakly developed resin pockets in the phyllaries. Few specimens have been recorded in the present study that document the occurrence of *I. plurifolia* in Arizona: Cochise Co., 9 mi SE of Cochise, 8 Aug 1936, *Anderson 1266* (NMC); Graham Co., Sulphur Springs Valley below Fort Grant, 4 Sep 1919, *Eggleston 15929*-GH; [Pima Co.], Empire Ranch, 20 Sep-4 Oct 1902, *Griffiths & Thornber 278* (NY); "southern Arizona," Sep 1874, *Rothrock 694*-GH, NY); "alkaline plains," 11 Sep 1884, *Pringle s.n.*-GH, NY-2 sheets. These plants have deeply cut corolla lobes and other relatively features of *I. plurifolia*, except for the densely hispidulous leaves and the stems, which vary from hispidulous to sparsely short-puberulous or -villous. A plant from southwestern New Mexico (Luna Co., Columbus, *Hershey s.n.*-NMC) also belongs with these. The Anderson collection, however, is glabrous, and except for it, these plants appear to form a natural unit; all are best associated with *I. plurifolia* and may eventually warrant formal taxonomic recognition, based primarily on their stem vestiture.

The type of *Linosyris hirtella* A. Gray has densely hirtellous stems and leaves, and similar scattered collections, though mostly with less dense vestiture, have been made in southwest Texas and southern New Mexico, as well as in Arizona. It is possible that this reflects an ancestral relationship between *Isocoma plurifolia* and *I. tenuisecta*, which also has hirtellous herbage, dense capitulescences, and deeply cut corolla lobes. The two species, however, apparently are sympatric in southeastern Arizona, and no evidence of intergradation in leaf shape or phyllary morphology has been noted. A contrasting hypothesis regarding the closest relative of *I. tenuisecta* follows its description.

The type collection of *Isocoma halophytica* B. Turner was made in the southeastern corner of the range of the species (almost certainly in Chihuahua

rather than "Coahuila" as noted on the label, though very near the state line). These plants have densely short stipitate glandular stems and leaves but otherwise fall within the variability of *I. plurifolia*. Two other collections of the same highly glandular morphotype have been made near Laguna Jaco in the vicinity of the type locality (*Stewart & Johnston 1955*-GH, LL; *Stewart 667*-GH), but nearly identical forms occur scattered through the range of the species (*e.g.*, Reeves, Brewster, Presidio, and Hudspeth cos. in Texas, and in Eddy and Chaves counties, New Mexico, particularly in the vicinity of Roswell in the latter). These glands apparently are papillae raised above the leaf surface, perhaps in response to a highly gypseous substrate, such papillae otherwise occurring imbedded on leaf surfaces of many plants lacking a glandular appearance.

Both diploids and tetraploids have been reported within *Isocoma plurifolia*, but these ploidy levels do not appear to be correlated with differences in morphology or geography.

12. *Isocoma rusbyi* E. Greene

Isocoma rusbyi E. Greene, Leafl. Bot. Observ. Crit. 1:170. 1906. LECTOTYPE (designated here): UNITED STATES. Arizona: [Navaho Co.], Holbrook, 20 Aug 1883, *H.H. Rusby 651* (US!; Isolectotypes: GH!, ND-G!, NY-2 sheets!, UC).

Shrubs 45-90 cm tall. Leaves narrowly elliptic oblong to elliptic obovate, entire, mostly 2-4 mm wide (-10 mm in Coconino Co.), completely glabrous and without marginal cilia, punctate glutinous or less commonly papillate. Heads 19-25 flowered, the involucres (5.5-) 6.0-9.5 mm long, 5.0-7.5 mm wide; phyllaries narrowly triangular-lanceolate with acute apices, apically glutinous, the hyaline margins often very broad and often minutely ciliate fringed; receptacles with long, lanceolate-attenuate, lacerate alveoli. Corollas 5.0-6.5 mm long, the tube 2.8-3.8 mm long, lobes triangular, 0.8-1.1 mm long. Achenes 2.8-3.5 mm long, 8-10 ribbed, the ribs thick, resin filled, and often forming "horns" at the apex. Chromosome number, $n = 6$ pairs (Solbrig, *et al.* 1964, as *Haplopappus drummondii*; Keil 1979, as *I. drummondii*; Turner & Flyr 1966, as *I. heterophylla*).

Arizona, Utah, New Mexico, and Colorado; rocky or sandy soil, less commonly in clay, desert shrub communities, usually in saline soil, sometimes with scattered junipers, 750-1500 m; August-October (-November).

This distinctive species has been mistakenly identified both as *Isocoma drummondii* and *I. plurifolia*. See comments following *I. azteca* regarding putative intermediates between it and *I. rusbyi*. Only one specimen of *Isocoma rusbyi* from Colorado has been seen in the present study ("S.W. Colorado,

near the Utah line," Aug 1875, *Brandegee 1208*-NY), although it may be more abundant in that state.

13. *Isocoma tehuacana* Nesom.

Isocoma tehuacana Nesom, *sp. nov.* TYPE: MÉXICO. Puebla: Tehuacan, Dec 1841, *Liebmann 526* (HOLOTYPE: NY!; Isotypes: GH!, GH-tracing and fragment *ex herb.* Klatt!, MO!).

Isocomae venetae (Kunth) E. Greene similis sed vestimento puberulo caulium ac foliorium, tubis sericeis corollarum, et acheniis longioribus differt.

Subshrubs 2-3 dm tall, the stems and leaves densely short puberulous with hairs with thick, orange resinous bases quickly tapered to filiform, whitish, crisped apices. Leaves narrowly oblanceolate to oblanceolate, 1-2 cm long, 2-3 mm wide, with 1-3 pairs of aristate teeth. Heads broadly turbinate, basally obtuse, ca. 20 flowered, the involucres 4.5-6.0 mm high, 6-7 mm wide; phyllaries glabrous, each with a distinct, dark greenish, punctate glandular apical area, the apex blunt to rounded, the margins with a very narrow, scarious rim, sometimes distally ciliate fimbriate; receptacles with lanceolate-lacerate alveoli. Corollas 5.5-7.0 mm long, the tube 3.0-4.0 mm long, prominently sericeous, the lobes deltate, 0.6-0.9 mm long. Achenes 2.8-4.0 mm long, densely sericeous, with 4-6 resinous ribs. Chromosome number unknown.

Known only from the type collection.

The plants represented in this collection are from slightly outside the southern periphery of the range of *Isocoma veneta* (Map 4) and they differ from it in the puberulent vestiture of their stems and leaves, sericeous corolla tubes, and longer achenes. Eleven branches are included on the type sheets, and the Klatt tracing shows yet another apparently from a European herbarium. It is unusual that this taxon is known from only a single, historical collection, but it is clearly outside the range of morphological variation in its widespread and much more common relative, *I. veneta*. *Cronquist 11243* (NY) from near San Sebastián El Seco, Puebla, has narrow leaves and somewhat puberulent stems, but the leaves are hispidulous and in all other features as well, it is typical of *I. veneta*. This is the only collection of the latter species observed during this study that has even slightly puberulent vestiture. It might be interpreted as intermediate in this respect, but overall, it clearly belongs with *I. veneta* rather than the plants from Tehuacan.

14. *Isocoma tenuisecta* E. Greene

Isocoma tenuisecta E. Greene, Leafl. Bot. Observ. Crit. 1:169. 1906. LECTOTYPE (designated by Benson 1940): UNITED STATES. Arizona: mesas about Tucson, 10 Sep 1867, *C. Smart* (ND-G; Isolectotype: US!). *(H)Aplopappus tenuisectus* (E. Greene) S.F. Blake *ex* Benson, Amer. J. Bot. 27:188. 1940. The ND-G specimen chosen as the lectotype by Benson has not been relocated in the present study.

Isocoma fruticosa Rose & Standl., Contr. U.S. Natl. Herb. 16:18. 1912. TYPE: MÉXICO. Sonora: MacDougal Pass, near the Pinacate Mts, 14 Nov 1907, *D.T. MacDougal s.n.* (HOLOTYPE: US). *(H)Aplopappus fruticosus* (Rose & Standl.) S.F. Blake, Contr. U. S. Natl. Herb. 23:1493. 1926.

Plants minutely hispidulous on the stems and leaves, usually densely so, commonly strongly glutinous. Leaves pinnatifid, 2.0-3.5 cm long, the blade and lobes 0.5-2.0 mm wide. Heads 8-12 (-15) flowered, the involucres 4.0-6.5 mm long, 2.0-2.8 mm wide; phyllaries narrowly oblong-lanceolate, the inner with broad, scarious margins, apices with a small, sharply delimited, nonaristate, green resinous area, often distinctly thickened and approaching a resin pocket; receptacles with low, broad, but acute alveoli. Corollas 4.5-6.0 mm long, the tube 3.0-3.5 mm long, the lobes triangular, 0.8-1.2 mm long, 1/3-1/2 the length of the limb. Achenes (2.0-) 2.5-3.1 mm long, with 6-8 thin, resinous ribs, lightly to densely sericeous. Chromosome number unknown.

Southern Arizona, New Mexico, and northern Sonora; sandy soil, gravelly hills, grasslands, most commonly in matorral or stands of *Larrea*; 750-1600 m; September-November.

Isocoma tenuisecta is known from México only by the type collection of *I. fruticosa*. "Haplopappus hartwegii var. tenuisecta" and "Bigelovia hartwegii var. tenuisecta," names appearing on a few collections and both attributed to A. Gray, were apparently never published. See further comments following *I. plurifolia*.

Isocoma tenuisecta resembles *I. plurifolia* in its relatively few flowered heads in dense, corymboid capitulescences and its long corolla lobes. On the other hand, the minutely hispidulous vestiture and phyllary morphology are more similar to that of *I. acradenia* than that of *I. plurifolia*. Although *I. tenuisecta* produces thickened phyllary apices throughout its range, often approaching resin pockets, they appear to be more strongly developed where the species is contiguous in geography with *I. acradenia* var. *acradenia* in southwestern Arizona, particularly in the area of Organ Pipe National Monument (Pima Co.). For example, the leaves of *Felger 87-272* (TEX) and *Clark 10994* (GH) are glutinous and densely hispidulous as in *I. tenuisecta*, but they are primarily linear with minute, shallow teeth or short, linear spreading lobes, or on some

plants the upper leaves are entire, the lower pinnatifid. Further, these individuals have phyllaries with distinctive resin pockets. Similar plants have been collected to the north in Pima Co. in the vicinity of Cubo (*Clark 11111*-GH, *11119*-GH) and slightly further in Maricopa Co. around Sentinel (*Hall 11032*-GH; *Jones 25086*-LL, NY, US); typical var. *acradenia* also occurs in these areas. In the early stages of this study, some of the specimens from Sentinel were annotated as *I. acradenia* var. *eremophila*, but it seems more reasonable to regard them as intermediates between var. *acradenia* and *I. tenuisecta*. They are mapped (Map 1) as *I. tenuisecta*.

15. *Isocoma tomentosa* Nesom.

Isocoma tomentosa Nesom, *sp. nov.* TYPE: MÉXICO. Chihuahua: Baños de San Diego, 1.8 km E of San Diego de Alcala, ca. 16 km NE of jct of local road with Hwy 45 (the jct 19.5 km SE of jct of Hwy 45 and road to Aquiles Serdan, SE of Cd. Chihuahua); ca. 1200 m, abundant on gyp hill, most past flower; 14 Oct 1986, *G. Nesom 5478* with L. Vorobik (HOLOTYPE: TEX!; Isotypes: ARIZ!, ASU!, CHIDIR!, COLO!, ENCB!, GH!, KANU!, MEXU!, MO!, NMC!, NY!, RM!, S!, TEX!, UC!, US!, WIS!).

Isocomae plurifoliae (Torr. & A. Gray) E. Greene similis sed vestimento dense albo-tomentoso caulium foliorum ac phyllariorum, foliis marginibus profunde dentatis, capitulis majoribus, corollarum tubis sparsim sericeis, et acheniis longioribus differt.

Caespitose subshrubs 1.5-7.0 dm tall, not at all glutinous. Stems moderately to densely and closely tomentose-puberulous with distinctly whitish hairs. Leaves oblanceolate to narrowly oblanceolate, 10-25 mm long, 2-6 mm wide, with (1-) 2-8 pairs of spreading, blunt to aristate teeth, tomentose-puberulous, less commonly hirtellous, sometimes sparsely and minutely stipitate glandular. Heads arranged in a relatively few headed corymboid capitulescence, campanulate, basally rounded, with 17-27 flowers per head, the involucres 4.0-7.0 mm long, 4.5-7.0 mm wide; phyllaries relatively thin textured, the apical area green, not punctate, the apex rounded, not aristate, densely to moderately or sparsely white puberulous; receptacles with low, circular alveoli. Corollas 5.5-7.0 mm long, the tube 2.8-3.5 mm long sparsely sericeous, the limb 2.0-3.2 mm long, the lobes 1.0-1.5 mm long, ca. (1/3-) 2/5-1/2 the length of the limb. Achenes narrowly turbinate, 2.0-3.0 mm long, densely sericeous, with 6-8 thin, slightly resinous ribs; pappus of numerous, slender, white, barbellate bristles 4.5-5.5 mm long. Chromosome number unknown.

Known only from the type locality at Baños de San Diego, Chihuahua, on a hill of exposed gypsum with numerous other gypsophilic perennials, just W of an area of hot springs and small streams flowing into salt flats, ca. 1230 m at the hill crest.

Isocoma tomentosa occurs at the southern periphery of the geographical range of *I. plurifolia* and is similar to it in its deeply cut corolla lobes. On the basis of geography, the two would be suspected to be related as sister taxa, but the new species is unexpectedly different in morphology. *Isocoma tomentosa* differs from *I. plurifolia* in the white pubescent vestiture of its stems, leaves, and phyllaries, toothed leaves, larger heads with more flowers, arranged in much smaller capitulescences, low circular alveoli, corollas with sparsely sericeous tubes, and longer achenes.

The type collection represents 39 separate plants, including one entire plant (mounted as a TEX isotype) and 38 additional branches, each of the latter removed at the base from a different plant and selected to show the range of variation in vestiture and leaf morphology in the population. The species is characterized by a closely white tomentose vestiture and regularly serrate leaves, but a low percentage of the plants (3 of the 39) have entire, hirtellous leaves, very similar to some forms of *I. plurifolia.* Even these, however, which have been annotated as *I. tomentosa* " > plurifolia," have sparsely puberulous stems and 18-21 flowered heads; in Arizona the stems of *I. plurifolia* may be sparsely puberulous, but the large heads of *I. tomentosa* would be unusual anywhere in the range of *I. plurifolia.*

Collections of typical *Isocoma plurifolia* have been made in the area of San Diego (plains near San Diego, 10 Sep 1891, *Hartman 759*-GH; 31 km N of Julimes, *Johnston, et al. 12344*-LL; Meoqui, 18 Aug 1935, *LeSueur 180*-GH, TEX). The plants of all of these have very small heads with few flowers and small achenes (phyllaries glutinous, the longest 3 mm long, flowers 10-12 per head, achenes 1.5-1.8 mm long, with pappus 3-4 mm long) and are clearly outside the range of any of the plants of *I. tomentosa.* It is possible, however, that variation among the plants of *I. tomentosa* toward *I. plurifolia* is influenced by genes from these nearby populations of the latter.

16. *Isocoma veneta* (Kunth) E. Greene

Isocoma veneta (Kunth) E. Greene, Erythea 2:111. 1894. BASIONYM: *Baccharis veneta* Kunth, *Nov. Gen. Sp.* [folio] 4:53. 1818; [quarto] 4:68. 1820. TYPE: MÉXICO. [Morelos]: near Cuernavaca, *Humboldt & Bonpland s.n.* (HOLOTYPE: P, P-fiche!). *Aster venetus* (Kunth) O. Ktze., *Rev. Gen.* 318. 1891. *(H)Aplopappus venetus* (Kunth) S.F. Blake, Contr. U.S. Natl. Herb. 23:1492. 1926.

(H)Aplopappus discoideus DC., *Prodr.* 5:350. 1836. LECTOTYPE (designated here): MÉXICO. 1831, *Alaman s.n.* (G-DC fiche!, photo-US!). DeCandolle also cited several other specimens from different collectors, all clearly shown on the fiche of the G-DC collections.

Linosyris mexicana Schlecht., Linnaea 14:Litt.-Ber. 128. 1840. TYPE: MÉXICO. Illustration *in* Ind. Sem. Hort. Hal. 1839:9, pl. 4. 1840.

Subshrubs 0.3-0.7 m tall, with stems and leaves sparsely to moderately minutely hispidulous. Leaves fleshy, mostly obovate-cuneate, 2-6 mm wide, with 1-4 pairs of shallow, short spinescent teeth. Heads 17-26 flowered, hemispheric to broadly turbinate, rounded to acute at base, the involucres 5-7 mm long, 4-5 mm wide; phyllaries glabrous, the lower part indurated stramineous, the apex greenish, glandular punctate and glutinous. Corollas 4.2-6.0 mm long, the tube 2.0-3.5 mm long, the lobes deltate to deltate triangular, 0.6-1.0 mm long. Achenes 1.6-2.8 mm long, with 3-6 thick ribs and several, mostly subepidermal nerves on the faces, densely sericeous. Chromosome number, $n = 6$ pairs (Anderson, *et al.* 1974; Powell & Turner 1963).

Coahuila, Nuevo León, Tamaulipas, Zacatecas, San Luis Potosí (northern system), and Hidalgo, México, Distrito Federal, Morelos, Tlaxcala, Puebla, Veracruz, [Oaxaca?, Guerrero?, see comments below] (southern system); sandy loam, volcanic or limestone derived soil, saline flats, grassland, matorral; 2250-2850 m; June-November (-December, -February).

Isocoma veneta comprises two population systems slightly separated from each other in central México. Plants from the southern system (including the type locality) have leaves that range larger than those from the north. Leaves of northern system are 5-16 mm long, 2.4-5.0 times longer than wide; those of southern system are 10-35 mm long, 4.2-6.0 (-8) times longer than wide, but if 8 times then the leaf barely lobed and on a branch with relatively wider leaves. Several collections from around Esperanza, Puebla (e.g. *Purpus 2633*-GH, MEXU, MO, US) have more deeply incised leaves, approaching the morphology of *I. hartwegii*, but then others from the same vicinity grade into the typical form.

A specimen noted as having been collected in Guerrero (Cerro del Pino, 14 Jul 1940, *Miranda 460*, MEXU) was probably instead taken in the state of México (see, for example, collections from Cerro de los Pinos, Edo. México, MEXU, NY, US). A collection of typical *Isocoma veneta* is reported on the label to have been collected in Oaxaca (Tlapujahua, 1850, *Keerl s.n.*-GH). No other collections from Oaxaca of this species have been discovered, and, like that from Guerrero, the Keerl record needs to be corroborated.

Additional comments regarding the relationship of *Isocoma veneta* to *I. menziesii* and *I. hartwegii* follow the latter two species.

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